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A Description of Specific Morphological Skills for Ten Group III Aphasics

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A DESCRIPTION OF SPECIFIC MORPHOLOGICAL SKILLS FOR TEN GROUP III APHASICS

(TITLE)

BY

Claire Braker

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CHAPTER I

Statement of the Problem

"Learning a language involves acquiring discrete elements and acquiring operational rules.... These processes go hand in hand. We do not learn sounds, then learn to put sounds together to make words, then learn to put words together into sentences.... It seems clear, also, that we do not learn and store sentences for retrieval on an appropriate occasion. We appear to learn a finite set of rules to make it possible to generate innumerable sentences" (Schuell, Jenkins, and Jimenez-Pabon, 1964, p. 98). In the study of linguistic behavior of an adult aphasic, it can generally be assumed that these basic language learning processes were essentially intact before his neurological trauma. From Schuell's et al. (1964) study, one can infer that many premorbid aphasics did possess sufficient intelligence and the necessary finite set of linguistic rules for sentence formulation. With the onset of the cerebral vascular accident or other neurological trauma, however, a series of events bringing about visual, auditory, and/or linguistic impairments occurs.

The general aphasic population is a heterogeneous one comprised of persons manifesting various degrees of physiological impairment and communication skills. As a consequence, consistent scientific data collection is difficult. Aphasic behavior, however,

can be scientifically examined with proper control of the relevant parameters.

The need for careful examination of the aphasic's regression of linguistic skills by the utilization of proper control of the relevant parameters is indicated by the lack of existing data. In order to better understand the mechanisms of language and to better plan a rehabilitative approach for the aphasic's relearning of language it is necessary to see what effect the neurological trauma has had on the finite set of rules that once governed the aphasic's ability to efficiently formulate language. Some hypotheses have been offered by various authors (Jakobson, 1956; Osgood, 1963; Schuell, *et al.*, 1964) to explain the aphasic's sudden inability to generate spontaneous language. No conclusive data have been obtained from these studies in regard to generalized language behavior.

Although various theories concerning human linguistic behavior have been set forth recently (Chomsky, 1964; Osgood, 1963; McNeill, 1967; and Jakobson, 1956) only a minute amount of research has been done in the field of the aphasic's morphological language. The hypothesis testing that has been centered around the area of child language acquisition (Muma, in press) does not shed much light in the area of aphasic regression of language skills. The onset of the cerebral vascular accident brings with it concommitant medical, physical, emotional and social impairments which only serve to confound the language impairment. With linguistics as vast a field as it is, and with the additional auditory, visual,

psychological, medical and social variables imposed by intervening concomitants, it is apparent why progress in aphasia linguistic research has been so cumbersome.

To investigate the linguistic behavior of an aphasic, one must know something about the rules the aphasic has at his disposal for the formulation of meaningful language. In aphasia, the extent to which these rules diverge from those of English, the native language, determines the extent to which these rules diverge from those of well formed English sentences. "The rules which underlie spoken English are known by all native speakers of English" (Cooper, 1967, p. 77). We assume therefore, that these rules were available to the premorbid aphasic. This is not assuming that the aphasic was able to state any of the rules explicitly, but that he knew the rules in the sense that he could apply them in producing utterances which he had never heard. "The ability to produce novel yet grammatical English utterances requires a knowledge of English formational rules.... One class of English formational rules is morphology, which is a system of rules by which the smallest meaningful language units, or morphemes, are combined into words" (Cooper, 1967, p. 77).

Morphological rules give us information about tense, mainly past or present, about number, mainly singular or plural, about possession, mainly through prepositional phrases, and derivatives, usually prefixes of suffixes (Miner, 1967). The explicitness of morphology allows for the selection of a particular set of rules for an investigation; thus an investigator is permitted

better control of the variables.

The present investigation was concerned with the aphasic's knowledge of inflectional suffixes pertaining to pluralization, tense and derivation. This study sought to identify the conditions under which these morphological rules function. To study this proposal, Group III aphasics (Schuell's 1964 classification) were chosen to insure some homogeneity of aphasic behavior. Schuell categorizes Group III as those aphasics having "severe reduction of language in all modalities complicated by sensorimotor involvement" (Schuell, et al., 1964, p. 190).

To establish some reasonable conditions which facilitate the functioning of morphological rules, it was necessary to establish baseline behavior for the aphasics. The establishment of a baseline is necessary not only for behavior but for all phases of aphasic involvement. Fundamental baseline measures are lacking in the field of aphasia research. Comparison of past experiment scores to a baseline score permits the investigator to evaluate the effects the imposed variable has had on the results of the experiment, while controlling and eliminating other undesirable behavior processes. Future investigators can then use these previously controlled variables as imposed variables in an attempt to determine their effect on baseline scores. Such a criterion is necessary not simply because extraneous processes may reduce the sensitivity of the baseline, but because they prevent unambiguous evaluation of the data (Sidman, 1960, p. 320). Anyone familiar with the complexity of aphasia must realize the

effect that the myriad of operating variables can have upon the linguistic functions of the aphasic. If a test, training, retest situation were imposed, an established baseline would allow for the calculation and graphic representation of learning (Griffith and Miner, 1972; Sidman, 1960). In other words, an established baseline would serve as a reference point for other linguistic and neurological studies in the area of aphasia. According to Sidman (1960) it is necessary first to examine a phenomenon and then to generalize to the pertinent population.

Previous studies in the area of aphasia linguistics and particularly morphology (Goodglass and Hunt, 1958a; Goodglass and Mayer, 1958b; and Googlass and Berko, 1960) have failed to examine the phenomenon morphological rule competence as the main variable. In other words, they failed to operate from a baseline thereby leaving their results and conclusions open to question. An initial baseline score could have permitted the examiner to determine the effects medical, physical, emotional, social and/or therapeutic variables had on the results. Without the baseline score the examiner could not be sure what changes occured due to the variables being studied. Substantiated conclusions are lacking as a result of this variability. In light of baseline measures, previous studies could be redesigned in order to account for certain variables. More important than replication and redesign is the direct building of studies from the established baseline with the introduction of additional morphological rules, plotting their function and injecting still more formational linguistic rules.

Existing studies seem to lack the linguistic tools needed for an accurate investigation of the formational linguistic rules. Difficulty can be seen in the variability of the measures used to examine morphological rules. From the existing morphological studies, it appears that much difficulty may have stemmed from the inadequacy of the measure. With the exception of Goodglass and Berko (1960), all evaluative measures used lexicon words as criteria. Berko (1958) found that for child language nonsense stems were more indicative of linguistic competence while lexicon words were more indicative of linguistic performance. She attempted to apply a similar nonsense technique with a small group of aphasics but met with little success. The results showed no specific reasons for aphasic difficulty with nonsense words. Goodglass and Berko later applied lexicon words as the sole criterion measure of morphological ability and obtained more varied responses (Goodglass and Berko, 1960).

These two criteria, lexicon words and nonsense words, were not administered in conjunction with one another and provided no opportunity for comparison of task learning. Newfield and Schlanger (1968) in a comparison of normal and educable mentally retarded children's knowledge of morphological rules found that the presentation of a lexicon words test first facilitated task learning, thereby providing a transition into the test of nonsense stems. Thus it appears that the presentation of pretest training items for each set of words (lexicon and nonsense), in addition to the order of test administration, would further simplify the requirements

for the aphasic and improve the effectiveness and accuarcy of the measure. Effectiveness improved in that there was less chance of the results being colored by complicated instructions and lack of task comprehension.

It is forseeable that a morphological test or even a screening version could be a valuable portion of an aphasic evaluation in that it could lend information in regard to the level of linguistic functioning and could serve as an index of severity. This is particularly intriguing if one considers the research of Shriner (1971). Shriner suggested that meaningful stimuli are processed at the representational level of the ITPA (Illinois Test of Psycholinguistic Ability) or Osgood Model where rules of syntax assist to facilitate resynthesis. The more systems brought into play (such as syntax, semantics, etc.) the easier the task becomes for the child, and thus short-term memory recall should be facilitated. This means that with the addition of the syntax-semantic components, the less complex the task of the mediating process at the representational level with respect to the automatic level. The automatic level, according to Shriner and Miner's (1968) results, processes non-meaningful stimuli. It can be argued that the meaningful task, "Here is a hat. Here are two _____," is really a test of the representational level of the model. Shriner and Miner's results then would be a test of the automatic level of the model ("Here is a vabe. Here are two _____."). The difference between the nonsense and lexicon stimuli and thus the two processing levels could conceivably serve as an index of severity of linguistic

impairment. A good criterion measure also has therapeutic implications since it could provide the clinician with relevant information about the functionality of morphological rules.

These are all things to be determined after a measure has been tested and retested. This baseline investigation of the present study only begins to supply the necessary information about the lexicon-nonsense measure being applied. From these results, the strengths and weaknesses in the measure can be ascertained and provisions for revision made.

When considering the importance of a good criterion measure, one must reflect on the previous research by Goodglass and Berko (1960). They employed twenty-one subjects to investigate the aphasic's ability to produce orally common English sentences. A lexicon word test served as the criterion measure for this group. The investigators sought to compare aphasic results obtained in 1960 with children's results obtained in 1958. It is curious to note that two different techniques of evaluation were employed, lexicon words for the aphasics and nonsense words for the children. Here also is one reason for questioning the results. Cowan et al. (1967) stressed that the measure is a very crucial variable in the interpretation of results. The measure alone, plus the lack of control of subject variables, greatly reduces the reliability and validity of the study.

In addition to the use of two different measures, Goodglass and Berko (1960) also employed ex post facto data in their study. Comparing child results obtained in 1958 to aphasic results from

1960 only increased the chance of erroneous and misleading interpretations of the results. It is not possible to apply controls to a phenomenon which has already taken place. Ex post facto research is accompanied by three built in weaknesses: 1) no variable control, 2) no active manipulation of variables, and 3) no randomization of subjects (Kerlinger, 1964, p. 359-375). One may argue that ex post facto research allows for random selection of subjects from those subjects observed. It does not, however, permit two more important randomization features: the assigning of subjects to groups and/or the assigning of treatment (criterion measure) to groups (Kerlinger, 1964). This was just the case with Berko's ex post facto (1958) data; it was not possible to control the independent variable in the child-aphasic comparison study (Goodglass and Berko, 1960). It could not be determined that the subjects were the only variables affecting the results. The interaction effect of the measures upon the results has already been discussed, thus presenting additional and unaccounted for variables. With such lack of variable control, one can only wonder about the interpretation of the results.

From the morphological studies thus far, it can also be seen that the variability within the aphasic group has not been controlled. No specific critera were established for subjection, thus permitting the following variables to go unaccounted for: specific type of cerebral insult, locus, extent of brain lesion, time (or the interval between onset and examination), age premorbid handedness and education, presence or absence of hemiplegia, and severity (Smith,

1971). Smith (1971) has demonstrated the importance of the consideration of these variables in the evaluation of aphasic subjects' linguistic capabilities.

The present investigation preposed to control for these variables and others via a record sheet listing pertinent medical, physical, emotional, social and therapeutic variables for each participating subject. These variables were studied in conjunction with the results.

To summarize, previous research has produced only minimal information about the nature of aphasic language. The present descriptive investigation attempted to produce results which would:

(1) Supply information about the conditions under which some morphological rules function in aphasia;

(2) Provide a method for establishing baseline behavior for aphasics in the area of morphological competence;

(3) Compare the effectiveness of a lexicon-nonsense measure in assessing morphological competence;

(4) Present interpretation of results in light of data generated by the study as opposed to ex post facto data; and

(5) Apply measures in an attempt to insure adequately control of subject variables.

The need for these goals follows logically from past experimental data in the area of aphasic linguistic performance, and more particularly, morphological performance.

Statement of Purpose

The purpose of this study is to describe specific morphological language skills for ten Group III aphasics in light of certain pre- and postmorbid medical, physical, emotional, social, and therapeutic variables. The following questions were taken into account:

1. Is there a statistically significant difference in the scores for lexical words as compared with nonsense words?

2. Is there a statistically significant difference in the scores for expressive items as compared to receptive items?

3. For each morphological rule tested, how many correct responses were elicited?

CHAPTER II

Review of Related Literature

The purpose of this chapter is to review a portion of the literature dealing with aphasia language. Initially, this review presents relevant historical linguistic studies. The review narrows as research in agrammatism is presented and terminates with the scrutiny of previous studies in the area of morphology.

"The study of aphasia brings innumerable insights and crucial observations to our understanding of language mechanisms that would not be evident from observation of normal language mechanisms alone. But these are fragmentary and tend to resist the efforts to bring them into a coherent pattern that would provide a basis for an explicit theory of the underlying neural arrangements" (Howes, 1967, p. 182-183). These fragmentary findings plagued the first investigators such as Pick, Ombrédanes, Salomon, and Isserlan and still plagues today's researchers.

Pick's (1913) theoretical analysis proposes that the process of grammatizing consists of a <u>conceptual phase</u> followed by a <u>linguistic phase</u>. The first step in the conceptual phase is the global idea, which, in turn, evokes specific mental content---not yet arranged in linguistic form. The linguistic phase begins with the activation of a sentence framework and proceeds to

finding words to slip into the slots of the framework. The underlying attitude of the speaker is believed to evoke melodic-intonational patterns that are important aspects of the sentence framework.

Agrammatic speech according to Pick's idea, represents a loss of the linguistic phase of speech while rendering the conceptual phase virtually undamaged. The disturbance is of a verbal-expressive nature in which the grammatical organization is the chief phenomenon.

Salomon (1914) pursued the question of parallels between expressive and receptive agrammatism and was convinced that these two modalities were independent. His position was reaffirmed by Isserlin (1922), who published a case of an agrammatic aphasic. The subject evidenced expressive difficulty with grammatical forms, but normal comprehension of the same forms. Another patient could not distinguish the appropriateness of one preposition from another or of one inflectional form from another, yet understood normal sentences adequately.

Several case reports based on collaboration between linguists and clinicians have appeared in the last ten years---one of the most interesting pair of case descriptions by Panse and Shimoyama (1955) of agrammatism in Japanese patients. This study serves to illustrate the variability between subjects diagnosed as having a similar aphasic disturbance. Because the Japanese language is highly inflected, with grammatical morphemes in the body of words as in the forms of long suffixes, it is particularly significant to examine the form of grammatical difficulties in the language.

One of Panse and Shimoyama's cases appeared to be a typical Broca's aphasic who omitted and failed to distinguish among grammatical morphemes of certain classes. A second case presented a fluent aphasic who produced circumlocutory and repetitious speech in which, however, grammatical forms were preserved.

Jakobson (1956) looked at the aphasic linguistic problem as a disturbance manifesting itself in one of two major types of disorganized speech. Jakobson saw these as illustrating two fundamental and complementary components of language---the paradigmatic or concept-naming aspect and the syntagmatic, or grammatizing aspects. For the loss of syntagmatic ability, Jakobson coined the term <u>contiguity disorder</u>. The contiguity disorder is manifested in every linguistic operation that is based on the contiguity of one linguistic element with another. Contiguity disorder, as Jakobson described it accounted for the inability to sequence familiar grammatical arrangements.

The second disorder posed, that of <u>similarity</u>, represents the aphasic's inability to use words to symbolize concepts. Developing further the hypothesis of contiguity and similarity disorders, Jakobson states that in the agrammatic "the tendency to abolish syntactic rank leads to the reduction of speech to nouns and nominal forms of verbs in holophastic usage" (Jakobson, 1964).

Jakobson considered the dichotomy between similarity and contiguity disorders to support the older distinction between "sensory-receptive" and "motor-expressive" types of disorders

(Miner, 1967). This would seem to lend support to the results reported by Salomon (1914) and Isserlin (1922). Schuell and Jenkins (1959), however, refuted Jakobson's theory when they demonstrated the high relationship between the aphasic's receptive and expressive performances on test items. This would seem to imply that although damage is more pronounced in one area (sensory or motor) the other area is also damaged to some lesser degree. The receptive and expressive processes do not appear to be independent.

Jakobson (1956, p. 71-72) postulated that "the syntactical rules organizing words into a higher unit are lost; this loss, called agrammatism, causes the degeneration of the sentence into a mere "word heap." The aphasia affecting contexture tends to infantile one sentence utterances and one-word sentences. The aphasic's degeneration of linguistic skills is a mirror of the child's acquisition of such skills. Several studies, as we will see later in the review, tried to confirm this hypothesis.

Schuell (1966) in an exhaustive comparison between adult aphasics and children with language disabilities (four- and five-year-olds) concluded that "...it appears most probable that language disturbances in adults and children are similar in some dimensions and quite different in others" (Schuell, 1966, p. 44). Studies of adult aphasia have shown a dimension of language deficit that is not medality specific. "This reduction of language may or may not be complicated by further disruption of auditory, visual, spatial or sensorimotor processes, or by dyarthria"

(Schuell, 1966, p. 45). With these concomitants, it is not possible to specify the exact regression of aphasic linguistic skills.

Jakobson has provided a simple framework that other linguistic studies such as those by Wepman and Jones and their co-workers (1956, 1964) have used in their attempts to develop a classification system on the basis of linguistics. They have shown by means of form-class frequency analysis that several types of aphasics can be distinguished from normals on the basis of the distribution of nouns, pronouns, verbs and adjectives. One group, semantic aphasics, was exceptionally low in the infrequent words of all categories, particularly nouns, although they retained grammatical form and function and normal intonational patterns as well. These patients seem unable to recall the semantic relationship between specific terms and their referents.

Another group of aphasics was identified for whom the distribution of parts of speech was similar to that of normals yet whose speech made no sense. Wepman denoted this group as pragmatic aphasics, because it was considered to affect the pragmatic process. Charles Morris spoke of the pragmatic process as "the ability of the patient to use symbols purposefully to convey meaning"(Goodglass, 1968, p. 183).

In contrast to the two aforementioned types, Wepman at al. noted a form of aphasia in which substantive words are overused and function words are underused. This category is termed by them as syntactic aphasia in recognition of the destruction of syntax and the tendency toward telegraphic type of speech. This

same type of syntactic distrubance will be noted again in later research done by several French investigators.

Howes (1964) and Howes and Geschwind (1964) also performed an investigation of the distribution of grammatical function words as compared to content words. The subjects consisted of one group of eighty aphasics and three groups of normals: hospital staff (doctors vs. orderlies), college students, and hospital patients (free from cerebral disease and matched with aphasics for age, sex, occupation, and education). A minimum of 5,000 words were elicited from each subject. Responses were taped and transcribed onto computer cards. The grammatical analysis was systematically done by the computer. Howes and Geschwind found that they could demonstrate the relative impoverishment of functional words in one group of aphasics which they referred to as standard aphasics. In contrast, they found no difference between the performance of their jargon aphasics and the normal control groups. They reported on the basis of the results that the term agrammatism denoted as extreme disintegration of the linguistic skills that their subjects did not meet. Howe and Geschwind's dichotomy of aphasic types can be translated into more familiar terminology by equating Broca's aphasia with standard aphasia and fluent aphasia with jargon aphasia.

Mounin (1967) attempted to describe the characteristics of agrammatism in French speaking aphasics. He began his discussion with a commentary on the definitions of agrammatism posed by Dubois (Dubois, 1965; Hecaen and Angelergues, 1965), Cohen and

Hecaen (1965) and Lhermette (1965). According to Mounin, none of the definitions reached the operational level. If one were to combine the definitions he would arrive at the following: Agrammatism is the omission or irregularity of terms of grammatical liaison, grammatical words, functional words, small language tools, grammatical morphemes covering units of which syntactical function are too different to be analyzed in clinical research. Mounin refuted many of the positions taken by his fellow researchers. After reviewing each author thoroughly and applying his own research, Mounin was able to devise the following list of acceptable agrammatic characteristics:

1. Lack of grammatical tools;
2. Usage of substantives;
3. Infinitive verbs used in place of transformations;
4. Lack of accords in grammatical discourse---nominative in place of oblique;
5. Telegraphic style of speech;
6. Stereotyped phrases appear frequently (only production in which grammatical structures are correct); and
7. Agrammatism is not equal to the loss of grammatical function---label is misleading and should be replaced by "ataxia." (Mounin, 1967, p. 14-26).

The author, Mounin, provides a very lengthy and thorough criticism of French research in aphasia linguistics. His desire for a more operational definition is an important goal to strive for in future research; with such an operational goal would come a better understanding of the functioning of the linguistic mechanism in aphasia.

Dubois (1967) saw the aphasic linguistic mechanism as an autonomous system. He was interested mainly in the physiological substratum and the manifestation of language. The complex behavior

of language involves activities functioning at various levels of integration. Each is a specific behavior relevant to certain neurological mechanisms.

Dubois' Taxonomic-Distributional linguistic model attempts to classify and define successive and consecutive units by the next higher rank: the phonemes are defined by their combination with the morphemes, the morphemes with the phrase, and the phrase with the statement. Included within the taxonomic level are phonemes, morphemes and syntax.

Of importance to this present investigation is Dubois' theory of omission of morphemes. He hypothesized that certain morphemes are omitted becuase of their lack of necessity based on the superior syntactical unit. That is, the morpheme is either omitted or utilized based on the dependency within the propositional phrase (syntagmatic classes) or frequency of occurence. The theory of frequency would seem to be in line with the work of Wepman and Jones (1956 and 1964) and Howes (1964) and Howes and Geschwind (1964). The idea of rank dependency is interesting but in need of further investigation, especially if it is to be applied to the variable linguistic skills of the aphasic.

Dubois, Marcie and Hecaen (1967) theorized that there are two types of dysfunction due to neurological impairment: selection of morphemes and combination of units with syntactic patterns. An investigation of a group of agrammatic subjects produced the following characteristics:

1. Extreme difficulty or impossibility for the subject to

integrate morphemes within the articulated phrases that he had spoken without error;
2. Deficits in the formulation of a syntactic phrase;
3. Level of success is joined to the level of syntactical phrase---indication of masculine/feminine, singular/plural, tense or person;
4. Receptive knowledge is usually intact;
5. Prosody is usually intact;
6. In agrammatism, the syntactic pattern is limited to the nominal phrase sturcture;
7. Interpropositional relationships are reduced to forms of position of order;
8. Substitutions of the pause in sequences of phonemes play the role of noise interrupting the sequences; and
9. Linguistic economy in agrammatism appears in the reduction of grammatical rules to those words and rules that occur most frequently (Dubois et al., 1967, p. 21-24).

This listing represents Dubois et al.'s observation of agrammatical characteristics in sensory and motor aphasics. Some of their characteristics have been refuted by Mounin (1967) because of their lack of stability throughout the aphasic population. Mounin feels that some of the traits are not explicit enough to be used operationally.

The French have produced some very valuable and interesting information in the past years. Their research seems to be approaching the operational level much more rapidly than American research.

The bulk of research in the area of aphasic competence in usage of morphological rules has been conducted by Goodglass and associates (1958a, 1958b, 1960, and 1964). Inflectional endings or morphological suffixes lend themselves easily to experiments through the sentence completion technique. This technique is used almost exclusively in the studies that follow.

Goodglass and Hunt (1958a) set out to evaluate the following hypothesis: the possessive is more complex than the plural.

They speculated that the aphasic should have more difficulty with the possessive form than with the plural form, but none should have significantly more difficulty with the plural than with the possessive. In discrimination tasks, aphasics should again have more difficulty with the possessive but none should have significantly more difficulty with the plural.

Twenty-four expressive and receptive aphasic subjects were selected to participate in the study. Ten patients were subjects in both the expressive and receptive portion. Five subjects were retained for the receptive phase only due to perfect scores on the expressive portion. Two experimental tests were used in the study: the Expressive Final S Test and a Receptive Final S Test. Goodglass and Hunt offered a series of twelve items of the following type to the twenty-four subjects:

EXAMINER READS: My sister lost her gloves. (Repeated)
Question 1: What did she lose?
Question 2: Whose gloves were they?

The results showed over twice as many omissions of the possessive /'s/ than of the plural /-s/.

In order to evaluate the receptive aspects of these grammatical discriminations, a series of thirty correct and incorrect sentences were taped for a judgement of right and wrong by sixteen aphasics. Examples of incorrect items are:

OMITTED POSSESSIVE /s/: The ship anchor was lost in the storm.
OMITTED PLURAL /s/: There were three book on the table.
OMITTED THIRD-PERSON /s/: The soldier write home every week.

This discrimination experiment produced a parallel to the expressive experiment in that the omission of the possessive went

unnoticed more than twice as often as the omission of the plural. However, the omission of the verbal third-person /s/ went unnoticed three times as often as the plural.

In conclusion, the authors felt the severity of aphasia is significantly predictive of difficulty with the possessive /s/ on the expressive side. The prediction is only doubtfully related to the difficulty with the plural /s/. The information in this study yields vague implications for Jakobson's regression hypothesis. No conclusive statements can be made as to the validity of Jakobson's theory.

Goodglass and Hunt's (1958) study lacks the qualities of a strong study. The authors gave no accurate description of the aphasic subjects except their age range (25-70 years) and that they varied in severity. On the basis of this, the question can be asked: "What degree of severity is predictive of morphological regression in possessives?" The results cannot be considered reliable since the following variables were not controlled: severity, age, education, sex, and time since onset.

Goodglass and Mayer (1958) attempted to study the linguistic nature of agrammatism in aphasia. The subjects consisted of five aphasics selected on the basis of the following criteria:

1. Most of a patient's utterances showed a loss of fluency in connecting words into phrases;
2. Loss of inflectional forms and syntactical forms; and
3. Loss of melody and rhythm within short phrases.

The experiment consisted of administering a series of phrases and sentences at three levels of increasing length and complexity. The patients were required to repeat these phrases. They observed

that the agrammatic patient retains the key words of his sentence but tends to omit articles, relational words, and more important to this paper, inflectional endings. His speech becomes impoverished and choppy or as Jakobson terms it, "telegraphic." These findings are in keeping with those of Dubois et al. (1967) and Mounin (1967).

Their principle objective was to identify the syntactical operations which distinguisted the agrammatic from the nonagrammatic aphasic. They concluded that:

1. Fewer words were used to generate sentences by the agrammatic group;
2. The agrammatic group showed more morpholgoical errors;
3. The agrammatic group made more stereotyped inflections;
4. The total errors were more for the agrammatic group; and
5. The agrammatic group had more word finding difficulties.

The results seem, in this case, to support Jakobson's contiguity and similarity theories. The study, however, showed several instances of weakness. The population was not adequately described or controlled. Some over-generalizations appeared to be made on the basis of scant data with respect to linguistic competence.

Perhaps the strongest and most informative study dealing with the relationship between agrammatism and inflectional morphology was done by Goodglass and Berko in 1960. They investigated the aphasic's ability to produce orally common English words with inflectional endings appropriate for completing English sentences. The specific question asked was: "How does the order of aphasic difficulty with English inflection forms compare to the order of difficulty of forms for children?" The items investigated were

as follows:

1. Regular forms of the plural and possessive noun;
2. Simple past and third person singular present indicative of the verb; and
3. Comparative and superlative of the adjective.

The rank ordering of results for aphasics falls into three distinguishable groups:

1. Complex possessives---most difficult;
2. The plural /-əz/, past /-t/, /-d/, /-əd/, present /-s/ and /-z/ and the superlative /-est/---moderately difficult; and
3. Comparative and two forms of the plural: /-s/ and /-z/---least difficult.

The authors noted that the order of difficulty of inflectional forms in free conversation is not necessarily the same as that obtained under the experimental condition.

Comparison of aphasic results with children only partially supports Jakobson's regression hypothesis. Berko (1958) demonstrated the significance, in children's language, of the contrast between the simple, nonsyllabic allomorph of the final /s/ or final /d/ and the complex, syllabic forms of /-z/ and /-d/. The complex forms were much more often omitted by children ages four to seven than were the simple forms. The simple forms of all the inflectional endings were well mastered by children in this age range. However, Bellugi's (1964) more recent data from younger children show the plural is mastered before the possessive or the verbal inflection. Berko found children regularly have more difficulty with phonological complexity. This was the exception rather than the rule in aphasia. Aphasics had difficulty in complex or simple allomorphs in the areas of possessives and between

simple and complex allomorphs of the third person singular. No difficulty was noted in plural and past tense endings as is often the case with children.

One aspect of the study to be questioned is the comparison of the aphasic results gained by real word stimuli and children's results obtained by nonsense stimuli. The comparison was also made on the bases of ex post facto data on children (Berko's 1958 data was used for the children.). In the light of these objections the following conclusions should be considered as only tentative:

1. For aphasics, the difficulty of various inflectional endings follows a definite order which is based on grammatical function, not phonological similarity;
2. Phonological complexity is not as important for aphasics as it is for children in determining difficulty of inflection;
3. A common factor appears to underlie adequate performance with all inflectional endings studies except for simple past; and
4. The inflectional ending score is related to verbal agility in articulation, but not related to overall adequacy of speech.

It is suggested that, in some aphasics, the syntactic and inflectional aspects of grammar may be impaired independently of each other. Goodglass and Berko's (1960) results seem to reflect this theory.

The development (Goodglass, Quadfasel and Timerlake, 1964) of an objective means of assigning aphasics to the categories of Broca's and fluents permitted Goodglass (1968) to sample the aphasic's competence in the utilization of morphological inflections. Twenty-eight aphasics were divided into two diagnostic classes of categories. In spite of the fact that the fluents were a milder group of aphasics the order of difficulty of the inflections was the same for the two diagnostic groups. That is, the fluent aphasics

find the final /s/ of the possessive or third person singular much more difficult than the plural /s/ or /es/. Thus, they demonstrated that the contrast between these inflectional endings was not specific to the clinically agrammatic patient. On closer inspection of the data they found a difference between the two diagnostic groups that was suggestive, although short of statistical significance. The fluent aphasics performed somewhat worse on the complex than on the simple allomorph of the plural, past and third person present inflections, as had Berko's children and as did a group of brain-injured controls. The Broca's aphasics had more difficulty with the simple form in each case. The only explanation for this occurrence that the authors could devise was that the phonological prominence of the extra syllable is facilitating for the Broca's but not for the fluent aphasics.

The net result of this study was the demonstration of a universal hierarch of difficulty of grammatical inflections, which applies to the agrammatic and to the fluent aphasic equally. The clinical difference between these types of patients is not illuminated by their application of the rules of inflection. The one possible difference observed between the groups lies at the level of phonology, rather than of grammatical function.

Again, as in previous Goodglass studies, he fails to give an adequate description of the subjects involved. In this particular study, he also fails to give an adequate description of the stimulus material used. His results seem to agree with those of previous researchers, however, his results still lack reliability

and validity.

In conclusion, the intent of this chapter has been to present a review of the linguistic progress in aphasia and to demonstrate the need for further in depth and controlled investigations in the area of aphasia morphologic competence.

Few studies have attempted to impose controls over the necessary medical, physical, social, emotional and therapeutic variables which have been shown by Smith (1971) to have a significant effect on the interpretation of results. No study thus far has operated from a baseline; the examiner could not be sure what changes occurred due to the variables being studied.

There is need at this time to apply a baseline investigation in the area of aphasia morphology, a study attempting adequate control of intervening variables which if left uncontrolled will have an indeterminate effect on the results.

CHAPTER III

Subjects, Equipment, and Procedures

I. Selection of Subjects

Ten Group III aphasics served as subjects in this investigation, Group III being described by Schuell as a "...severe reduction in all modalities complicated by sensorimotor involvement. Auditory comprehension is generally good within the limits of observed retention span, but this span is very short. Reading and writing are severely impaired by reduction of language, but subjects utilize visual cues effectively. Visual discrimination, visual recognition, and recall of learned symbols are more intact than similar auditory processes" (Schuell, *et al.*, 1964, p. 197). Subjects were selected from the available population in East-Central Illinois and the Danville Veterans Administration Hospital.

Two criteria were chosen for the selection of an aphasic as a possible subject; they were as follows:

(1) Severity.--Each subject was administered a screening form of the Minnesota Test for Differential Diagnosis of Aphasia, if he had been tested using the MTDDA within the last six months. Results from the screening were compared with the scores on the most recent test. If a subject had not been tested within the last six months, he received a full MTDDA. (For a listing of the screening items see the Appendix I). To be considered a subject, each aphasic had to meet the Group III severity level. Group III was selected because of the severe reduction of language skills.

(2) Hearing.--All subjects were given a binaural puretone audiometric screening at a level of 35 dB at 250, 500, 1000, 2000, and 4000 Hz. Failure constituted the following: (1) no response to a tone presented at 45 dB and/or (2) no response to two tones presented at 35 dB in the same ear. These criteria were established to account for the large amount of failures due to the onset of presbycusis which often accompanies aging. One subject was excluded from the population due to failure of the hearing screening.

Eight male subjects from the Danville Veterans Administration Hospital and two male subjects from the East-Central Illinois area served as subjects for this investigation. For medical, physical, social, emotional, age and therapeutic characteristics for each case see Table I. A copy of the record form used may be found in Appendix II.

II. Examiner

Research by Cowan, et al. (1967) has demonstrated that the examiner can be a crucial variable in an experimental investigation. Therefore, this investigator conducted all testing with the aphasic subjects including the administration of the Minnesota Test of Differential Diagnosis of Aphasia and the morphology test. Such measures were an attempt to minimize examiner bias.

III. Language Measure

The language measure used in this study was a set of lexicon words and a set of nonsense stems. Berko (1958) demonstrated that nonsense stems are a good measure of competence and lexicon words a good measure of performance in her evaluation of children's knowledge of English formational rules. Goodglass and Berko (1960)

TABLE I

MEDICAL, PHYSICAL, SOCIAL, EMOTIONAL AND THERAPEUTIC CHARACHTERISTICS FOR EACH CASE STUDIED

Case	Age	Time Since Onset	Education*	Occupation	Diagnosis	Paralysis	Therapy	Other Variables
1	63	1½ yrs.	I	Handiman	CVA Brain Stem Deteration	Right	1 yr.	Anemia Paranchynal Disease, Hemianopsia
2	35	8 yrs.	II	Railroad Worker	Cerebral Degeneration	Degenerating Motor Control	6 mon.	Hunnington's Chorea Seizures
3	43	9 yrs.	II	Prisoner	CVA Cerebral Atrophy of Right & Left Hemispheres	Right	2 yrs.	Diabetes Smoker Alcoholic Schizophrenia
4	41	3 yrs.	II	Not Specified	Severe Organic Brain Impairment due to Carbon Monoxide Poisoning	Right	2½ yrs.	Alcoholic Overweight
5	49	14 yrs.	I	Railroad Worker	CVA Craniotomy	Right	2½ yrs.	Seizures, Diabetes, Smoker Alcoholic Skull Fracture Paranoid

(Continued)

TABLE I--Continued

Case	Age	Time Since Onset	Education*	Occupation	Diagnosis	Paralysis	Therapy	Other Variables
6	74	7 mon.	II	Factory Worker	CVA	Right	4 mon.	Arteriosclerosis Alcoholic Anemia
7	63	10 yrs.	II	Telephone Installer	Organic Brain Impairment due to Electric Shock	Right	None	Epilepsy Skull Fracture Gun Shot Wound to the Head Cardiovascular Disease Psychosis
8	72	30 yrs.	I	Laborer	Organic Brain Syndrome	None	None	Overweight, Diabetes, Smoker Epilepsy Syphilis Schizophrenia
9	64	2 yrs.	II	Post Master	CVA	Right	2 yrs.	Smoker Overweight
10	60	7 mon.	II	Not Specified	CVA	Right	6 mon.	Smoker Arteriosclerosis

*Educational Levels Achieved
I = Eighth Grade
II = Eighth to Twelfth Grade

showed that aphasics can apply morphological rules to lexicon words. If one looks at the results of the aphasic's morphological performance in the light of the Berko (1958) study, he might question whether the aphasic's performance was a function of overlearning or actual rule competence. On this basis it was decided to add an additional set of nonsense stems to the lexicon criterion measure to test rule competence. The nonsense stems and lexicon words were adapted from existing morphology tests by Berko (1958), Cooper (1967), Newfield and Schlanger (1968), and Shriner and Miner (1968).

This test represented an attempt to combine features of each existing test in order to obtain the most comprehensive measure of specific morphological rules. The specific set of rules were adapted from Berko's (1958) listing. The morphological rules investigated mainly pertained to regular application of the rules; thereby, providing information about the aphasic's knowledge of those linguistic rules which are applied frequently in everyday linguistic encounters.

This morphology test was composed of both expressive and receptive items. The aphasic was asked to generate verbal language in the application of morphological rules. In addition, he was asked to demonstrated his receptive skills by identifying graphic representations of the rule as the clinician presented both verbal and written directions. The nonsense stems provided an opportunity to evaluate the aphasic's competence in the use of inflectional endings by applying them to new forms.

Pretest training items were administered before the presentation of both the lexicon and nonsense tasks. This was to familiarize the aphasic with the nature of the task, eliminate complicated instructions and provide a transition from lexicon to nonsense items.

Pretest Training Items for Lexicon and Nonsense Items

The examiner presented both verbal and written directives to each subject. Each pretest item was presented in its entirety by the examiner. The examiner repeated that task omitting the last word from the verbal directive. The subject was asked to supply the omitted word plus the correct morphological suffix. After the subject performed this training task, the administration of the expressive-lexicon portion commenced.

Initial Instructions: "You are going to see some funny cartoon pictures. Some of them will have names you know. Some will have names you don't know. You will use the names you know or names you don't know at the end of a sentence."

"Let's try some names you know first."

Lexicon

1. Here is a jeep. Here is another jeep. Now there are two jeeps. Now you add the last word. (Repeat the directive omitting the last word.)
2. Here is a man who knows how to jump. Everyday he does it. Everyday he jumps.
3. Here is a boy who likes to jump. He did it yesterday. Yesterday he jumped.
4. Administration of the expressive-lexicon portion of the test.

Nonsense

Directions: "Now let's try some words you don't know."

1. Here is a peed. Here is another peed. Now there are two peeds. Now you add the last word. (Repeat the verbal directive omitting the last word.)
2. Here is a peed who likes to keet. Everyday he does it. Everyday he keets.
3. Here is a peed who likes to bing. Yesterday he did it.

Yesterday he binged.

4. Administration of the expressive-nonsense portion of the test.

The Expressive Phase

The expressive portion consisted of the following:

1. Nouns: Twelve nonsense and twelve lexicon items were used to test knowledge of rules of pluralization. Two irregular forms were included in the set of twelve nonsense and twelve lexicon items. The three regular forms were /-s/, /-z/ and /-əz/. The irregular rules tested was /-v/ substituted for /-f/ in words ending in /-f/.

2. Verbs: Eight nonsense and eight lexicon items testing present participle, past tense and present tense were used. The forms used were /-ɪŋ/, /-t/, /-d/, /-əd/, /-s/, /-z/ and /-əz/.

3. Possessive: Three nonsense and three lexicon items testing knowledge of the rules of possession were incorporated into the test. The forms were /-'s/, /-'z/ and /-'əz/.

4. Comparative and Superlative: Two nonsense and two lexicon items were used for testing each rule. The forms were /-er/ and /-est/.

5. Progressive and Derived: Two nonsense and two lexicon items were used to test each rule. The forms were /-ɪŋ/ and /-er/.

The Receptive Phase

Initial Instructions: "This time I will read the whole sentence. You don't have to talk. You are to point to the picture that the last word tells you to point to."

The receptive portion consisted of the following:

1. Nouns: Twelve nonsense and twelve lexicon items were used to test knowledge of rules of pluralization. Two irregular forms were included in the set of twelve nonsense and twelve lexicon items. The three regular forms were /-s/, /-z/ and /-əz/. The irregular rule tested was /-v/ substituted for /-f/ in words ending with /-f/.

2. Verbs: One lexicon and one nonsense item was used to test knowledge of the present participle /-ɪŋ/. One nonsense

and one lexicon item was used to test the past tense form /-t/. One nonsense and one lexicon item was used to test the present tense form /-z/.

3. Possessive: One nonsense and one lexicon item was used to test the possessive form /-'z/.

4. Comparative and Superlative: One nonsense and one lexicon item was used to test each of the following forms: /-er/ and /-est/.

5. Progressive and Derived: One nonsense and one lexicon item was used to test each of the following forms: /-er/ and /-est/.

Fewer items were included in the receptive phase of the test due to the difficulty in pictorial representation.

Verbal Directives for the Expressive Portion

1. Nouns: Here is a _noun_. Here is another _noun_. Now there are two _noun_.

2. Verbs:
   a. Present Participle: Here is a noun who likes to _verb_. He is doing it right now. Right now he is _verb_.
   b. Past Tense: Here is a noun who likes to _verb_. He did is yesterday. Yesterday he _verb_.

3. Possessive: This _noun_ has a noun. Whose noun is it? It is the _noun_.

4. Comparative and Superlative: This noun is _adjective_. This noun is even _adjective_. And this noun is the very _adjective_.

5. Progressive and Derived: This noun likes to _verb_. What is he doing? He is _verb_. He is called a _noun_.

Verbal Directives for the Receptive Portion

1. Nouns: Here is a _noun_. Look at all the pictures. Point to _noun_.

2. Verbs: Here is a noun who likes to _verb_. Look at all the pictures. Point to noun _verb or verb phrase_.

3. Possessive: This noun has a noun. Look at all the pictures. Point to _noun's_ noun.

4. Comparative and Superlative: This noun is _adjective_. Look at all the pictures. Point to the _adjective_. Point to the _adjective (est)_ noun.

5. Progressive and Derived: Here is a noun who likes to noun. Look at all the pictures. Point to noun _verb (ing)_. Point to the _noun (er)_.

Pictures depicting the actual objects or lexicon words were used as well as those depicting nonsense stems. Accompanying each auditory presentation of a verbal directive were two forms of visual stimulation. The visual stimuli were a pictorial representation of each words and a printed set of directives. (Hand printed manuscript was used, thus permitting larger, more discernible characters.) Both auditory and visual stimulation were used to make the best uses of two main sensorimotor modalities. Schuell _et al._ (1964) emphasized the need for a multiple modality approach when working with aphasics. (A listing of the morphological rules tested as well as the lexicon and nonsense words used for each rule appears in Appendix III.)

VI. Administration and Scoring

The two sets of test stimuli were administered individually, using the lexicon items first. Each subject was administered three pretest presentations to familiarize him with the task. This occurred for both the lexicon and nonsense words. After the presentation of lexicon items the nonsense stems were presented. The subject was asked to complete the open ended statement following the presentation of the verbal directive. For the receptive portion, the subject was asked to point to the picture that depicted the rule presented.

A correct response was one which depicted the correct stimulus

word as defined by Berko (1958), who used adult response to stimuli to determine the correctness of each item presented to children. It was hoped that the responses to the expressive portion would be intelligible, but provisions were made for written responses when necessary for clarification. In no case were written responses required during any of the ten testing situations.

V. Equipment

The test was designed in notebook fashion for ease of handling. Two, three-ringed notebooks were used. One contained expressive materials, the other receptive materials. Black and white line drawings accompanied by printed directives were placed in protective binders. (A sample of the expressive and receptive items appear in Appendix IV.) Blank, white pages were inserted between each test item to eliminate distraction caused by preceding and succeeding items. A scoring sheet with data analysis was used to record answers for each subject. (A copy of these forms appears in Appendix V.)

All verbal responses were recorded on an Ampex Model 601 tape recorder to insure accuracy of scoring.

CHAPTER IV

Results and Discussion

Introduction

Oral and gestural responses were obtained from each of ten group III aphasics. A test of morphological skills served as the criterion measure. In order to test the subject's knowledge of each morphological form, he was presented with three stimuli: pictorial representation, written and verbal directives. The responses obtained for the expressive portion were tape recorded. Both oral and gestural answers were charted on analysis sheets. The Mann-Whitney U, a nonparametric statistical test, was used to determine significant differences between expressive and receptive performance scores and between lexical and nonsense performance scores (Downie and Heath, 1965 and Siegel, 1956). An .05 level of confidence was set. The Lawshe-Baker Nomograph for testing the significance of the difference between two percentages was employed for comparison of individual morphological form scores (Downie and Heath, 1965). The .05 level of confidence was considered significant unless otherwise indicated. The percentage of correct responses for each set of morphological rules has been graphically represented and discussed in this chapter. A rank ordering of correct responses for individual forms has been included to help

summarize the results and to aid in planning therapy. The specific results follow.

Lexical vs Nonsense

Three questions were posed at the onset of this study. The first question concerned the difference between lexical scores as compared with nonsense scores.

1. Lexical vs Nonsense Words.

In answering this question a one tailed test was employed since it was hypothesized that lexical scores would be greater than nonsense scores. The above hypothesis was based on the findings of Goodglass and Berko (1960), Berko (1958), and Newfield and Schlanger (1968). In the Goodglass and Berko study (1960), they reported that aphasics were able to apply morphological rules to lexical words but were usually not able to apply the same rules to nonsense words. In the two studies concerning the child's knowledge of morphological rules (Berko, 1958 and Newfield and Schlanger, 1968) it was found that although each child could apply morphological rules to both lexical and nonsense words, lexical word scores were always higher than nonsense word scores.

The Mann-Whitney U test was used to evaluate the statistical significance of this data because of the small sample size and the ordinal level of measurement. Table 2 illustrates the findings of the comparison of lexical and nonsense word scores.

An obtained U value of 9 indicated that there was a statistically significant difference between lexical and nonsense scores.

Table 2. Summary of a comparison between lexical and nonsense words.

Items Compared	Level of Confidence	U Value	Critical Value
Lexical vs Nonsense	.05	9*	27

*U was significant beyond .001 level of confidence.

The lexical scores were higher than the nonsense scores as predicted. This difference in scores would seem to indicate the following:

1. In order to apply a morphological rule to nonmeaningful stimuli, the subject must have a thorough working knowledge of the usage of that particular rule as he cannot depend on familiarity with the word for rule application cues; and/or

2. As Shriner (1971) suggested, the lexcial stimuli may be processed at the representational level and the nonsense stimuli at the automatic level.

Expressive vs Receptive

The second question posed was concerned with the difference between expressive scores as compared with receptive scores.

2. Expressive vs Receptive Language.

In answering this question a one tailed test was employed since certain assumptions were made at the onset of this study. It was hypothesized that receptive scores would be greater than the expressive scores. This assumption was made on the basis of previous studies dealing with aphasic language performance (Schuell, et al, 1964; Dubois, 1967; Dubois, Marcie and Hecain, 1967). These studies demonstrated that aphasics with extensive speech and language involvement (Schuell's groups III, IV, V) often

retained more functional receptive language skills than expressive skills. Dubois (1967) and Mounin (1967) reported that when aphasics had functional expressive language it was usually "telegraphic" in nature. The telegraphic speech was reported to lack many grammatical forms which was depedent upon the context of the sentence and their position within sentence for meaning (adjectives, adverbs, pronouns, inflections, etc). With reference to receptive language ability, it was reported that when aphasics were presented with tasks which required the aphasic to make a simple motor response to signify his receptive comprehension, he was often able to perform the task successfully.

The Mann-Whitney U was chosen because this study employed small size and used measurement which was probably ordinal in level. A significance level of .05 was set for this measure.

Since the hypothesis stated the direction of the predicted difference the region of rejection was one-tailed. It consisted of all values of U which were so small that the probability associated with their occurrence under the null hypothesis was equal to or less than .05. The following table illustrates the results.

Table 3. Summary of a comparison between expressive and receptive items.

Items Compared	Level of Confidence	U Value	Critical Value
Expressive vs Receptive	.05	18.5	27

An obtained U-value of 18.5 with a critical value of 27, set for a one-tailed test at an .05 level of confidence, indicates the following: There was a statistically significant difference

between scores obtained for the expressive phase as compared to scores obtained for the lexical phase. Items in the receptive phase were more frequently performed correctly than expressive items. Thus the hypothesis made at the beginning of the study was accepted.

Morphological Rules

The third question dealt with the number of correct responses to each morphological rule tested. In order to answer this question, a graph and a description of that graph have been provided for each rule tested. The Lawshe-Baker Nomograph was the statistic used to determine the significance of the difference between two given percentages (Downie and Heath, 1965). Question three follows:

3. Number of Correct Responses for Each Rule.

Noun Plurals

Figure 1 represents the percentage of correct responses that aphasic subjects generated for the following three forms of noun pluralizations: /-s/, /-z/, /-əz/. Both receptive and expressive portions of the test were administered to each subject.

Within Expressive Process

Expressive Lexical--. Marked variability was observed within and between the types of expressive stimuli. For the lexical items, the scores for the /-s/ (83%) were not significantly different from either the scores for /-z/ (58%) or for /-əz/ (60%).

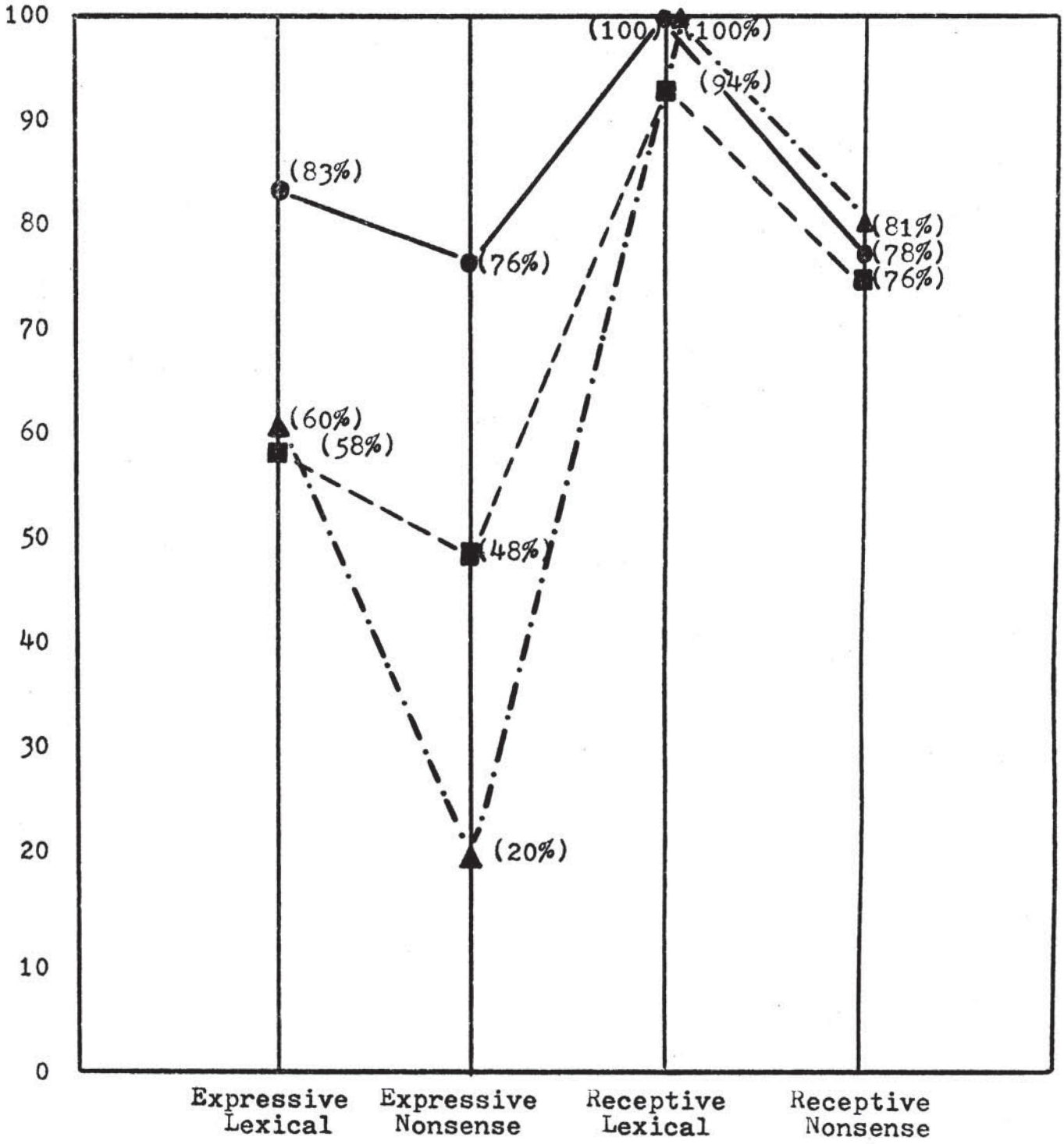


Figure 1. Percentage of correct responses for the noun plurals: /-s/, /-z/, and /-əz/ (● =/-s/, ■ =/-z/, ▲ =/-əz/).

Although /-əz/ achieved a higher score than the /-z/, there was not a significant difference between the two scores. Since this present study was baseline in nature and the sample size was small, it cannot be assumed that because there was no significant difference noted between scores that performance on these items was always comparable. A fifty percent difference between two percentages was required before the difference was significant at the .05 level. Another study involving a larger population is needed before conclusions concerning within rule results can be drawn.

Expressive Nonsense--. Large differences were exhibited among the scores for the plural forms tested at the nonsense level. The highest score was 76% for the /-s/. The /-z/ received the next highest score of 48 % and the /-əz/ the lowest score of 20 % correct responses. A significant difference at the .01 level of confidence exists between /-s/ and /-z/ scores. No other significant differences were noted.

Expressive Lexical vs Expressive Nonsense--. Between the two categories of expression one observes discrepancies between scores obtained on the lexical portion as compared to scores obtained on the nonsense portion. Nonsense scores were consistently lower. No statistically significant differences emerged between the scores. The following table may aid in comparing the lexical and nonsense scores.

Table 4. Summary of the percentage of correct responses for expressive lexical and nonsense items for pluralizations.

Form	Lexical Score	Nonsense Score
/-s/	83%	76%
/-z/	58%	48%
/-əz/	60%	20%

Within Receptive Process

Receptive Lexical--. The scores obtained for the lexical portion were clustered at the top of the range (between 90% and 100%). Only a minimal amount of score variability seemed to exist. This score variability of 6% occurred between the scores for /-s/ and /-əz/ (each 100 %) and /-z/ (94%). The difference was not statistically significant. The receptive lexical test item did not appear to be particularly discriminating for this group because of the small amount of variability. Scores were clustered at or near the top of the range. There was no true distribution of scores, indicating little or no difficulty in performance of this test item.

Receptive Nonsense--. A small dispersion of scores existed among the items in the receptive nonsense category. Scores were spread between 81% and 76%. The /-əz/ received a score of 81%, the /-s/ a score of 78% and the /-z/ a score of 76%. A comparison between scores indicated no statistically significant difference existed between any of the three possible comparisons. The narrow range of scores demonstrated that the subjects were all having

approximately the same amount of difficulty with the receptive nonsense portion of the test.

Receptive Lexical vs Receptive Nonsense--. The amount of discrepancy that occurred between lexical and nonsense scores was relatively stable for all forms, as may be seen in Table 5.

Table 5. Summary of the percentage correct for receptive lexical and nonsense items for pluralization.

Form	Lexical Score	Nonsense Score
/-s/	100%	81%
/-z/	94%	78%
/-əz/	100%	76%

No statistically significant differences were observed for any of the possible comparisons. For both portions /-z/ received the lowest score and /-əz/ the highest score.

Between Expressive and Receptive Processes

Receptive scores were consistently higher than expressive scores. Lexical scores were consistently higher than nonsense scores. The form showing the most marked discrepancy for either receptive or expressive portion was the /-əz/. A significant difference beyond the .01 level of confidence was noted between the /-əz/ expressive score of 20% and the receptive score of 100%. The /-s/ appeared to be the easiest morphological form to apply expressively, with the /-əz/ the most difficult to comprehend receptively. The graphic patterns (Figure 1) indicated peaks or

strengths for lexical forms and valleys or weaknesses for receptive forms.

Possessives

Figure 2 represents the percentages of correct responses for the possessive forms /-s/, /-z/, and /-əz/. For each form an expressive form was administered. A receptive test was only administered for the /-əz/. Information about possessives may be found in Figure 2 on the following page.

Within Expressive Process

Expressive Lexical--. Expressive lexical scores for /-s/ and /-z/ were at 40% each. The /-əz/ received a correct response score of 20%. The difference between the /-s/ and /-z/ forms and the /-əz/ form was not statistically significant.

Expressive Nonsense--. Nonsense scores for these forms were extremely low. The /-s/ received a correct response score of 10%. The /-z/ (0%) and /-əz/ (0%) items were not performed correctly by any of the subjects. No statistically significant differences were found between any of the three forms. The relevance of this item is questionable as no subject passed the item and little information can be gathered; that is, was failure due to the lack of subject knowledge or the nature of test stimuli? If further testing determines that low scores were the result of limited subject knowledge and not test stimuli, then the item can be considered relevant, as a good test consists of some items on which few

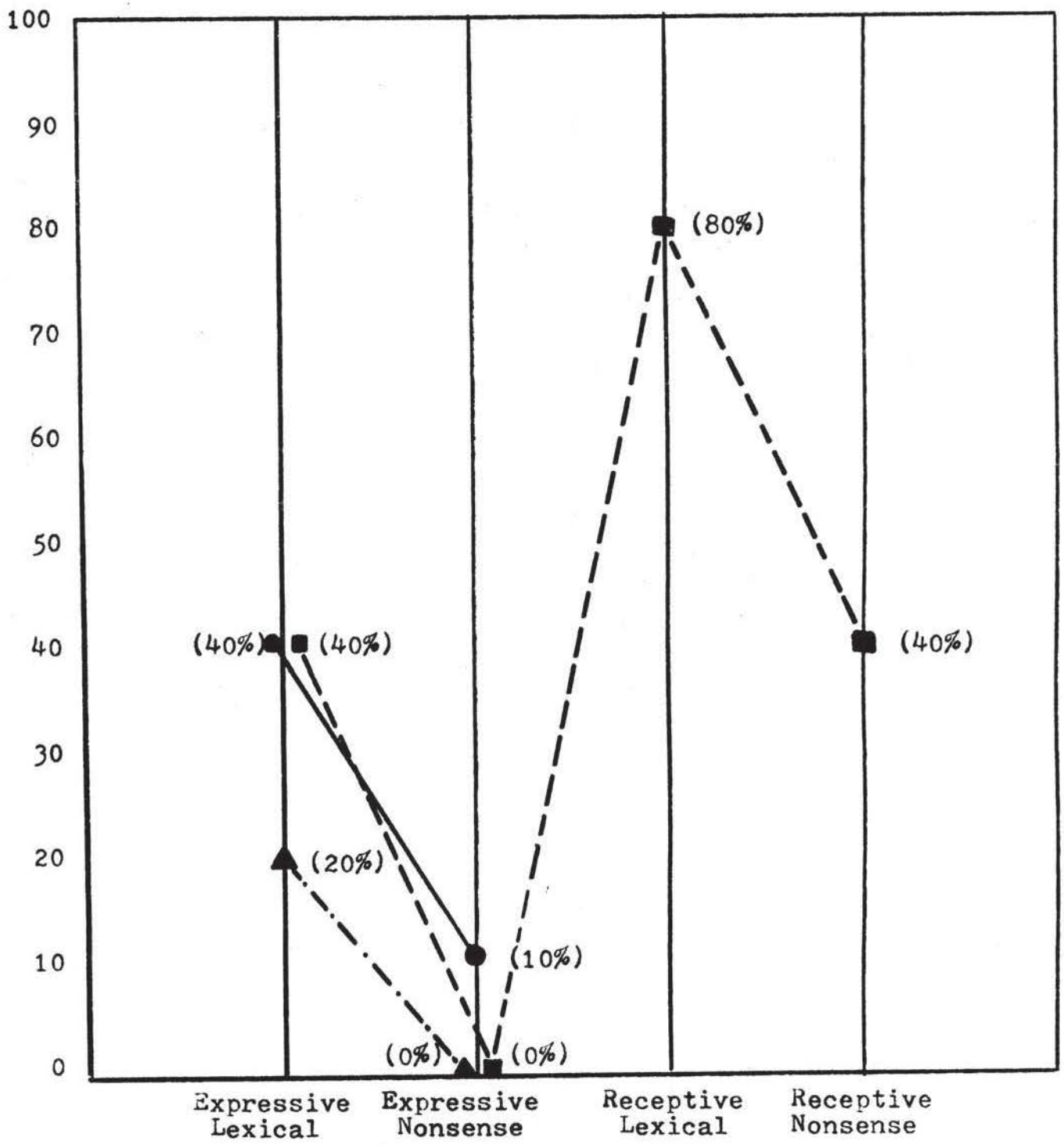


Figure 2. Percentage of correct responses for noun possessives: /-'s/, /-'z/ & /-əz/ (● = /-'s/, ■ = /-'z/ & ▲=/-'əz/).

subjects perform correctly. A wide range of item difficulty permits a more thorough evaluation of a subjects capabilities.

Expressive Lexical vs Expressive Nonsense--. Discrepancies between lexical and nonsense words were not statistically significant. The /-s/ form was the form receiving the most number of correct responses. Following is a table of percentage scores to allow for ease of comparison.

Table 6. Summary of the percentage correct for expressive lexical and nonsense items for possessives.

Form	Lexical Score	Nonsense Score
/-s/	40%	10%
/-z/	40%	0%
/-əz/	0%	0%

Within Receptive Process

Receptive Lexical--. The form /-z/, which was the only possessive form tested, received a percentage correct score of 80%.

Receptive Nonsense--. Again, /-z/ was the only form tested. Aphasics responded correctly to 40% of the items presented. The score was well below the score achieved for the same /-z/ (78%) form at the noun pluralization level.

Receptive Lexical vs Receptive Nonsense--. The /-s/ received 80% correct responses in the lexical portion and 40% correct responses in the nonsense portion. There was not a statistically significant difference between these scores.

Between Expressive and Receptive Processes

A statistically significant difference beyond the .01 level of confidence was observed between expressive nonsense /-z/ (0%) and the receptive lexical /-z/ (80%). No differences between scores were found to be significant. The receptive process scores were consistently higher than the nonsense scores.

Present Tense Verbs

The percentage of correct responses generated by aphasics for the present tense verb forms /-ɪŋ/, /-s/, /-z/, and /-əz/ are shown in Figure 3 on the next page. Expressive knowledge was tested for /-ɪŋ/ and /-s/. It can be observed that correct response scores for the three verb forms /-s/, /-z/, and /-əz/ were generally higher than scores for noun pluralization forms (Figure 1).

Within Expressive Process

The scores in this category were clustered into two groups: /-ɪŋ/ (75%) and /-z/ (70%) at the higher end and /-s/ (40%) and /-əz/ (40%) at the lower end of the range of percentage scores. There was not a statistically significant difference between any of the scores reported. The /-z/ scores were well above the scores for /-s/.

In studying the following table, one can observe that scores for all three rules differ with the pluralization rule being the least difficult form and the possessive rule being the most difficult form to apply. As one looks at the scores, he must remember the suffixes to be applied were the same for the three morphological

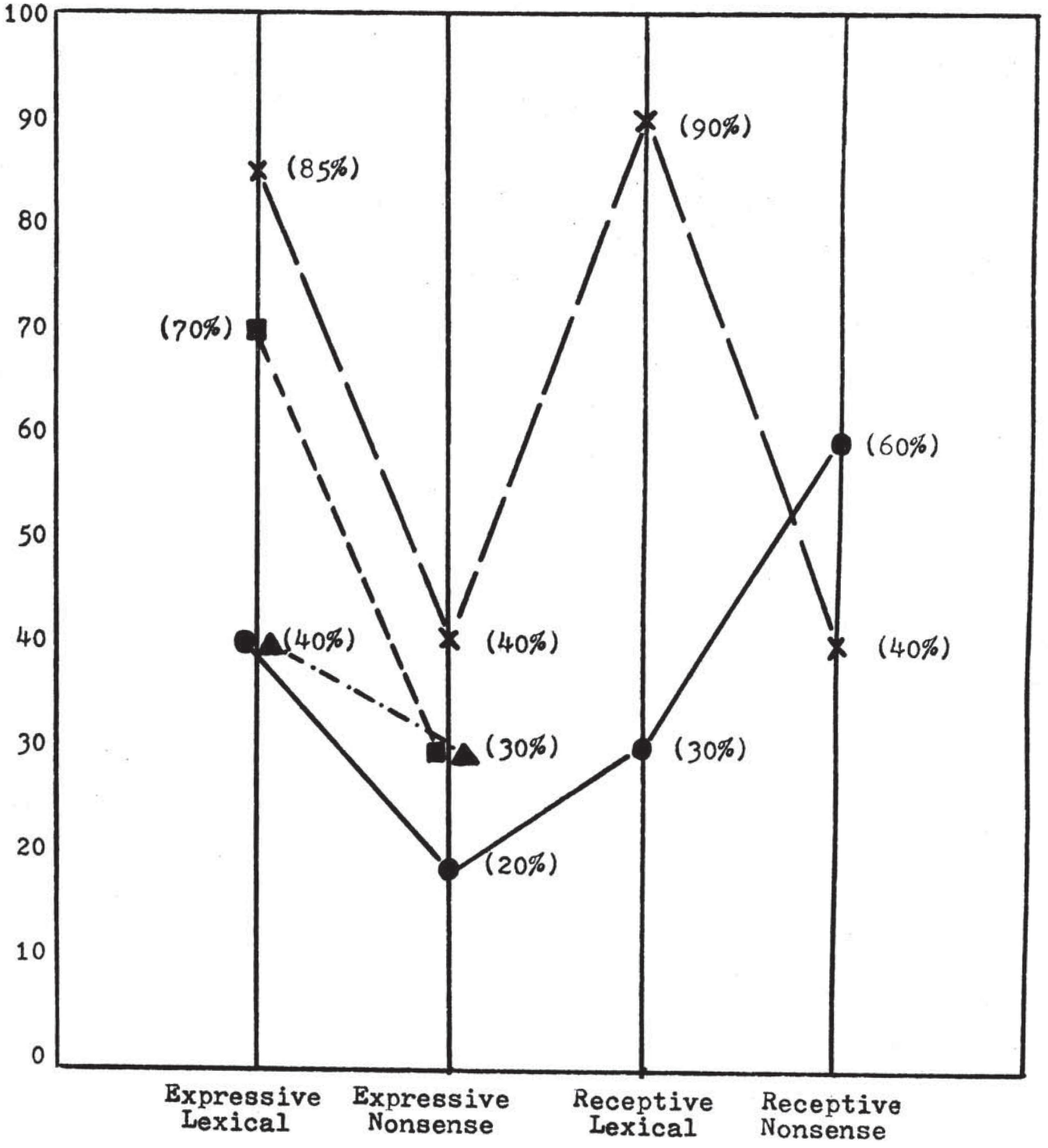


Figure 3. Percentage of correct responses for the present tense verbs /-ɪŋ/, /-s/, /-z/, /-əz/ (× = /-ɪŋ/, ● = /-s/, ■ = /-z/, ▲ = /- z/).

rules (/-s/, /-z/ and /-əz/). The differences between the three rules did not appear to be due to articulation difficulty as the scores for each suffix varied from rule to rule.

Table 7. Summary of percentage correct for noun plurals, noun possessives, and present tense verb expressive lexical scores.

Form	Plural Lexical	Possessive Lexical	Present Tense Lexical
/-ɪŋ/	—	—	75%
/-s/	83%	40%	40%
/-z/	58%	40%	70%
/-əz/	60%	20%	40%

Expressive Nonsense--. The verb present tense expressive nonsense scores were generally higher than those scores for possessives but lower than those scores for noun plurals. As in the lexical form, the /-ɪŋ/ recieved the highest number of correct responses (40%). The /-z/ and /-əz/ each received 30% correct response. The /-s/ received the fewest number of correct responses (20%). The /-s/ which received the highest scores for noun pluralization and possessives received the lowest scores for the present tense verb forms. The /-z/ and /-əz/ suffixes were not utilized correctly by any of the aphasics for the noun possessive rule. A table for these three morphological rules will aid in the comparison of the respective rules.

Table 8. Summary of percentage correct for plural, possessive, and present tense verb nonsense forms.

Form	Plural Nonsense	Possessive Nonsense	Present Tense Verb Nonsense
/-s/	76%	20%	20%
/-z/	48%	0%	30%
/-əz/	20%	0%	30%

Expressive Lexical vs Expressive Nonsense--. Although discrepancies existed between the two types of word stimuli presented, none were statistically significant. The following table depicts the percentage of correct responses for each present tense verb form.

Table 9. Summary of the percentage correct for expressive lexical and nonsense items for present tense verb forms.

Form	Lexical Scores	Nonsense Scores
/-ɪŋ/	75%	40%
/-s/	40%	20%
/-z/	70%	30%
/-əz/	40%	30%

Between the categories, the /-z/ evidenced the least amount of variability, the /-əz/ the most variability.

Within Receptive Process

Receptive Lexical--. Two forms were tested in the receptive lexical portion: /-ɪŋ/ and /-s/. There was a statistically significant difference at the .01 level of confidence between the scores

for /-ɪŋ/ (90%) and /-s/ (30%). The /-ɪŋ/ form evidenced a similar peaking in the receptive lexical portion as was depicted in previous graphs for possessives and plurals. The /-s/ form, however, evidenced only a slight increase in this category, relative to increases that appeared in previous morphological rule graphs (See Figures 1 and 2).

Expressive Nonsense--. The present tense scores for /-ɪŋ/ (40%) fell below the scores for /-s/ (60%) in the nonsense category. The /-ɪŋ/ form presented a downward sloping pattern as seen in the graph (Figure 3). The /-s/ however, can be observed to continue to slope upward. There was not a statistically significant difference between these two scores.

Receptive Lexical vs Receptive Nonsense--. There was a statistically significant difference between the lexical and nonsense scores for /-ɪŋ/ at the .05 level of confidence. There was not a statistically significant difference for the /-s/ scores. One can observe the unusual upward sloping in the receptive portion for the /-s/ form. This did not seem due to subject variability, but rather to the inaccuracy of the testing tool. The pictorial representations did not clearly depict the rule being tested, therefore causing confusion for the subject.

Between Expressive and Receptive Processes

A discrepancy significant at the .05 level of confidence was noted between expressive nonsense and receptive lexical for /-ɪŋ/.

No statistically significant differences existed for /-s/. The graphic pattern of /-ɪŋ/ was consistent with previous graphs. The /-s/ showed marked deviation from previous graphic patterns particularly in the receptive portion. This deviation was probably due to the lack of precise pictorial representations for that item.

Past Tense Verbs

Figure 4 on the next page represents the percentage of correct responses generated by aphasics for the following past tense forms: /-t/, /-d/ and /-əd/. All forms tested were done so expressively. Only /-t/ was tested receptively.

Within Expressive Process

Expressive Lexical--. Large discrepancies existed between the scores for /-t/ (70%) and /-d/ (30%) and /-əd/.(10%). The score for /-əd/ was statistically significantly different from the score for /-t/ at the .01 level of confidence. Other comparisons were not significant (See Table 10).

Expressive Nonsense--. The number of discrepancies within this category was substantially less than that observed for the expressive category. The /-t/ received a correct response score of 40%, the /-d/ 20% and the /-əd/ 10%. No statistically significant differences between scores were noted. The item difficulty was rank ordered the same for the expressive and receptive processes (See Table 10).

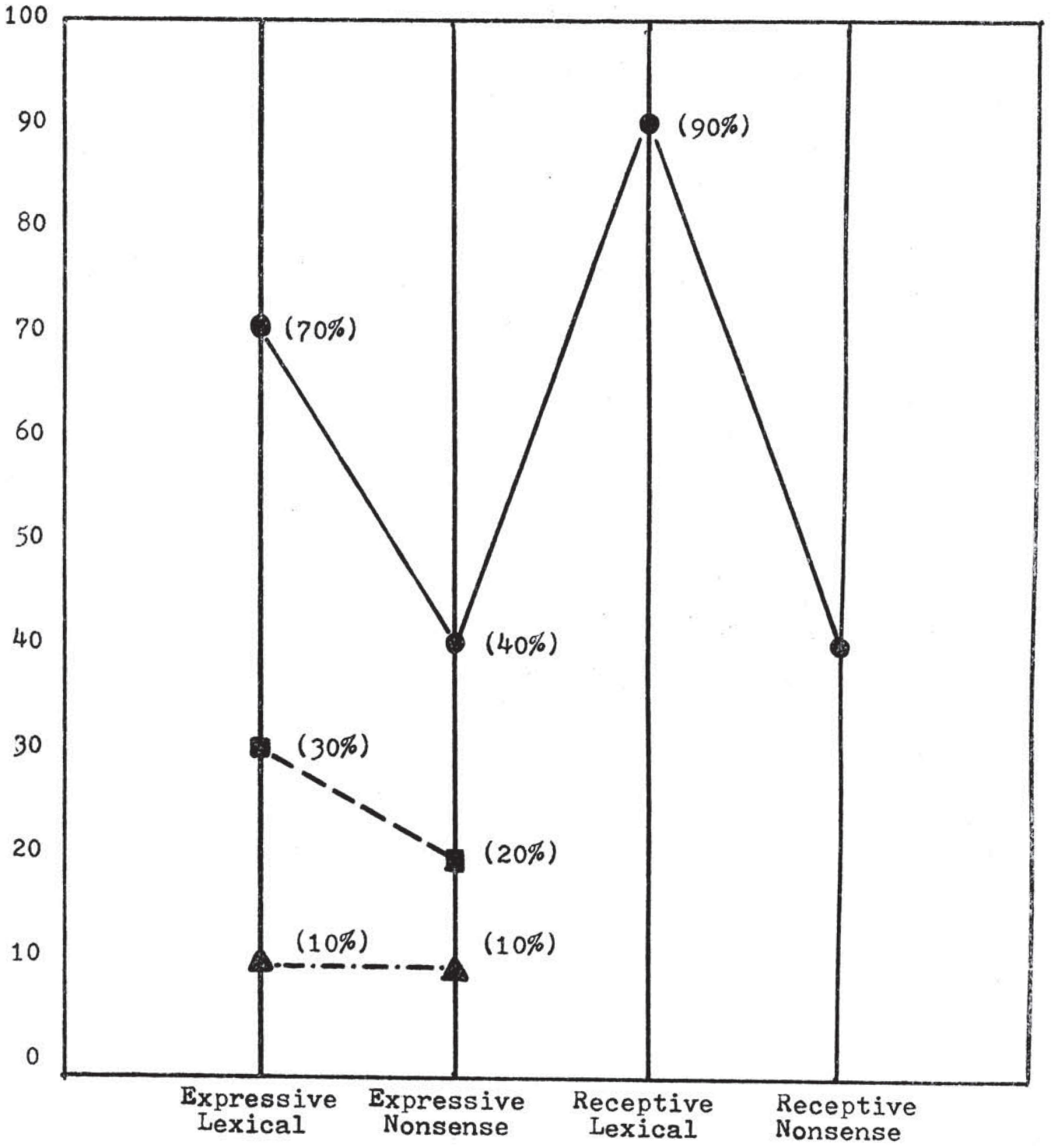


Figure 4. Percentage of correct responses for past tense verb: /-t/, /-d/, /-əd/ (● =/-t/, ■ =/-d/, ▲ =/- d/).

Expressive Lexical vs Expressive Nonsense--. It can be observed that the greatest between category variability existed within the /-t/ form. There was less variability between stimuli for the /-d/ form and no variability for the /- d/ form. A comparison table follows.

Table 10. Summary of percentage correct for expressive lexical and nonsense scores for past tense verbs.

Form	Lexical Scores	Nonsense Scores
/-t/	70%	40%
/-d/	30%	20%
/-əd/	10%	10%

No statistically significant differences existed between categories. The /-əd/ form may be a very discriminating item as few aphasics generated correct responses.

Within Receptive Process

Receptive Lexical--. Only the /-t/ form was tested at the receptive level. A score of 90% indicated that subjects had little difficulty comprehending this rule at the receptive level.

Receptive Nonsense--. The downward sloping pattern of the curve was similar to previous graphic receptive nonsense patterns (Figures 1, 2 and 3). The /-t/, the only form tested received a percentage of correct response score of 40%.

Receptive Lexical vs Receptive Nonsense--. There was a statistically significant difference at the .05 level of confidence

for /-t/ (90%) in the lexical category and /-t/ (40%) in the nonsense category.

Between Expressive and Receptive Processes

The only form that could be compared at this level was /-t/. There was a significant difference at the .05 level of confidence between the two processes and the two modes of stimuli for the /-t/.

Comparative and Superlative

Figure 5 which may be found on the following page represents the percentage of correct responses aphasics generated for the comparative /-er/ and superlative /-est/ morphological rules. Forms were tested both expressively and receptively.

Within Expressive Process

Expressive Lexical--. Expressive scores for both forms were rather low: 35% for /-er/ and 20% for /-est/. The discrepancy between the two forms was not statistically significant.

Expressive Nonsense--. The discrepancy between /-er/ and /-est/ was greater than for the lexical category, but still not significant. Scores, again were very low with 25% for /-er/ and 5% for /-est/.

Expressive Lexical vs Expressive Nonsense--. The discrepancies between categories for each of the forms /-er/ and /-est/ were not statistically significant. Nonsense scores were consistently lower than lexical scores.

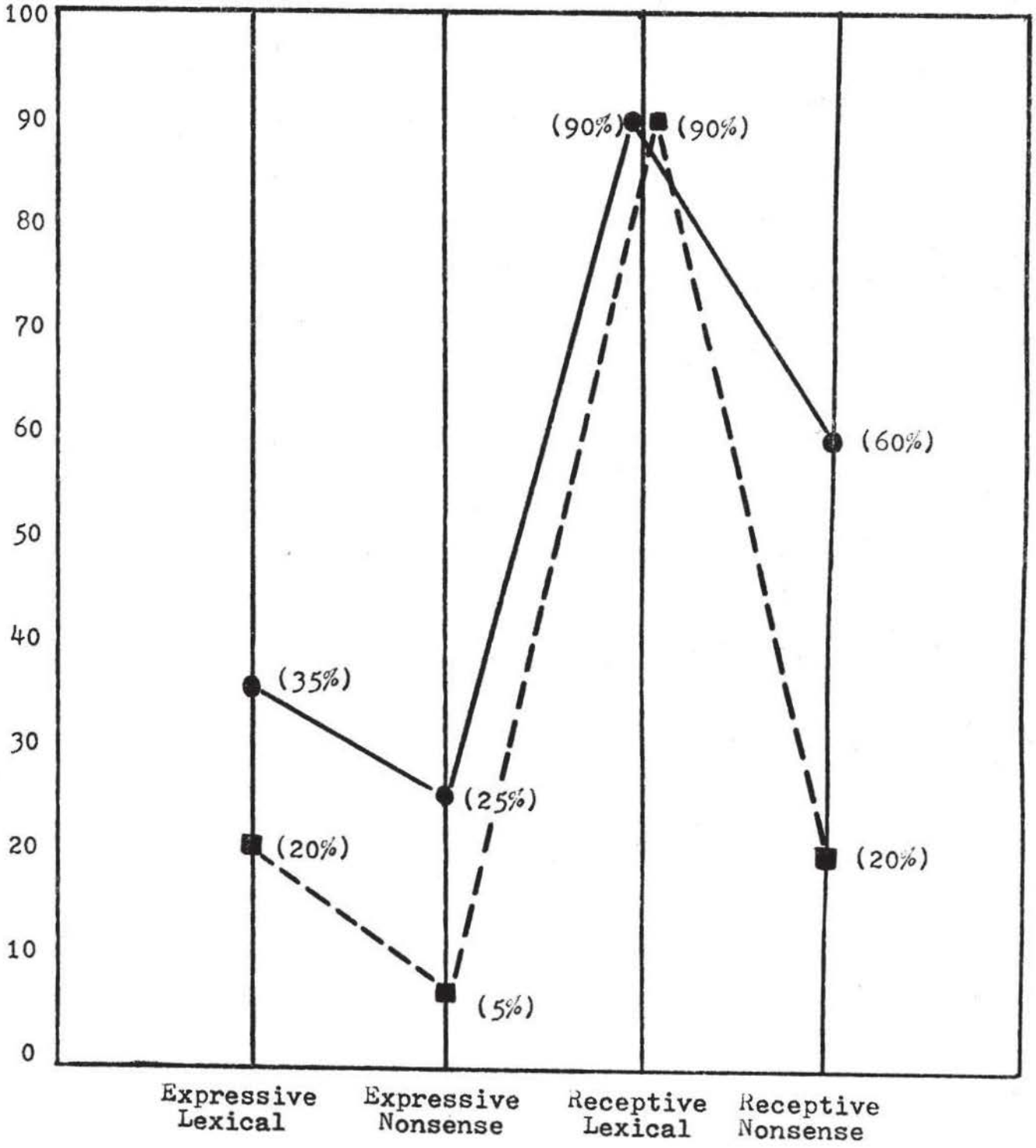


Figure 5. Percentage of correct responses for comparative /-er/ and superlative /-est/ (● = /-er/ and ■ = /-est/).

Within Receptive Process

Receptive Lexical--. The scores for both /-er/ and /-est/ were identical (90%). This indicated that this particular group of subjects was able to receptively process both the /-er/ and the /-est/ forms equally well.

Receptive Nonsense--. There was not a statistically significant difference between nonsense scores for /-er/ (60%) and scores for /-est/ (20%). Subjects seemed to evidence much more success with the /-er/ than the /-est/. Subjects failing the /-est/ items were persistent in pointing to an identical representation of the /-er/ item for their response to /-est/.

Receptive Lexical vs Receptive Nonsense--. There was a statistically significant difference beyond the .01 level of confidence for lexical /-est/ (90%) scores as compared with nonsense scores (20%). A significant difference did not exist for the /-er/ score for lexical as compared with nonsense.

Between Expressive and Receptive Processes

Scores for /-er/ were consistently higher for the receptive than for the expressive. This was not true for the /-est/ form where expressive nonsense was higher than receptive nonsense although no statistically significant difference emerged. Marked discrepancies existed between the two processes.

Progressive and Derived

Figure 6 which follows represents the percentage of correct

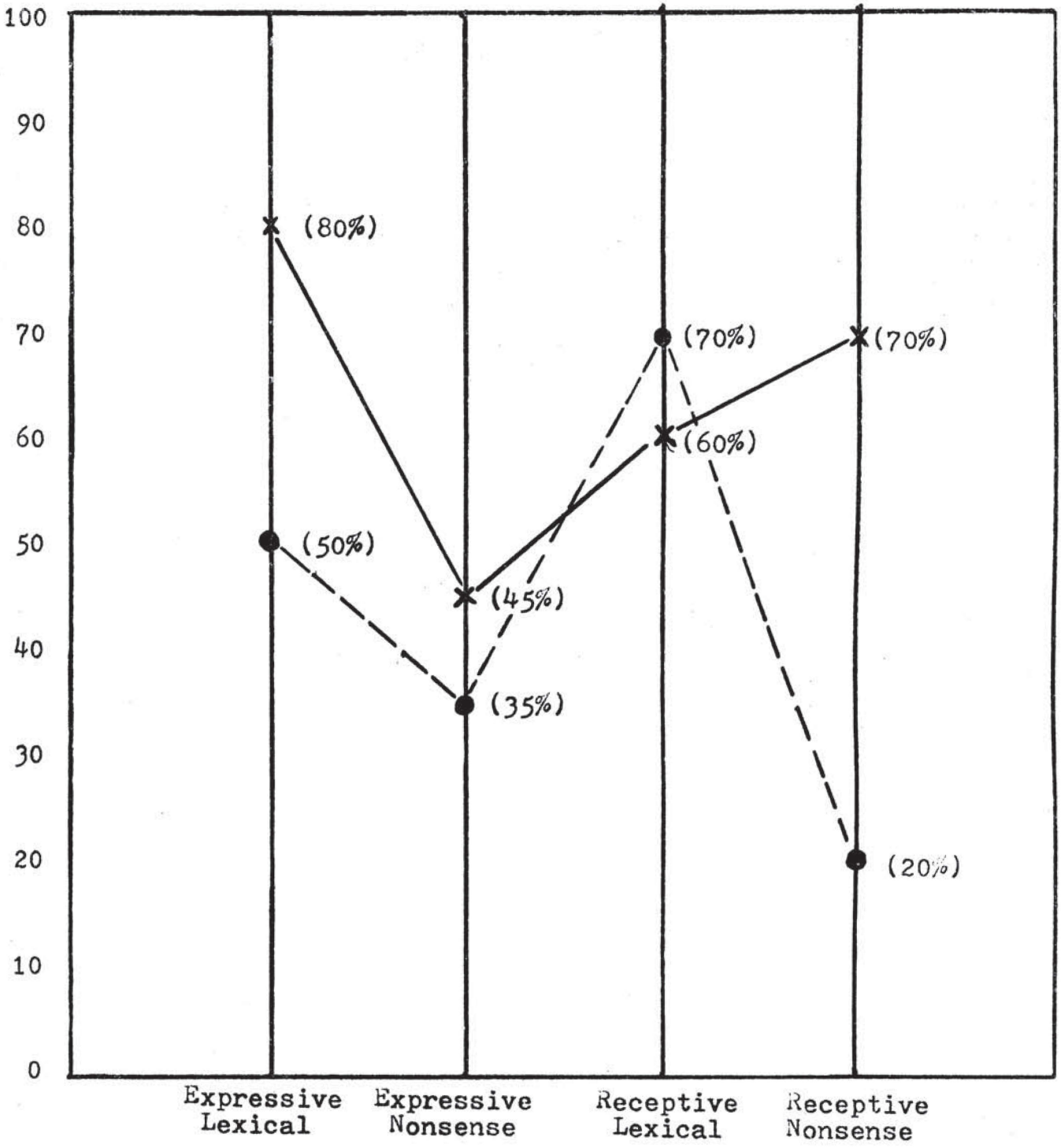


Figure 6. Percentage of correct responses for the progressive /-ɪŋ/ and the derived /-er/ (× = /-ɪŋ/, ● = /-er/).

responses aphasics generated for the progressive /-ɪŋ/ and derived /-er/ forms in expressive and receptive presentations.

Within Expressive Process

Expressive Lexical--. There was not a statistically significant difference between scores for /-ɪŋ/ (80%) and /-er/ (50%). The aphasics seemed to evidence a moderate amount of difficulty in generating responses for these forms.

Expressive Nonsense--. The variability between /-ɪŋ/ (45%) and /-er/ (35%) was not statistically significant. The difficulty encountered in generating correct responses was demonstrated more in the nonsense portion than in the lexical portion.

Expressive Lexical vs Expressive Nonsense--. There was not significant variability noted in comparing scores for the /-ɪŋ/ in the two categories. The /-er/ showed less variability between word stimuli than the /-ɪŋ/ form. The /-ɪŋ/ form was performed with a greater degree of success than the /-er/ form.

Within Receptive Process

Receptive Lexical--. The /-ɪŋ/ pattern of the upward sloping of scores was consistent with but lower than previous scores in the present tense verb test (Figure 3). There was no significant discrepancy between the /-er/ and /-ɪŋ/ forms.

Receptive Nonsense--. The /-ɪŋ/ pattern was not consistent with that of previous receptive nonsense representations. This indicated a possible weakness in the test, in that the curve slopes

upward similar to the present tense verb form /-ɪŋ/ in which subjects had difficulty because of unclear pictorial choices (Figure 3). There was a statistically significant difference at the .05 level of confidence between /-ɪŋ/ (70%) and the /-er/ (20%).

Receptive Lexical vs Receptive Nonsense--. The /-ɪŋ/ scores between the two categories appeared to be the result of the inaccuracy of the measure, in that the pictorial stimuli did not clearly represent the rule. There was significant difference at the .05 level for the /-er/ (70% compared to 20%).

Between Expressive and Receptive Processes

There was a discrepancy between expressive and receptive scores for the /-er/ form. It was not, however, of a statistically significant nature. There was a nonstatistically significant discrepancy between expressive and receptive process scores for /-ɪŋ/. It was difficult to evaluate the performance on the /-ɪŋ/ due to the upward sloping pattern of the receptive curve, which was not consistent with most of the receptive curve pattern. The curve pattern which was consistent with the progressive /-ɪŋ/ form was the present tense verb form /-ɪŋ/. Subjects had much difficulty with the present tense verb form (Figure 3) because of the lack of pictures which clearly represented the rule.

The following table illustrated the rank ordering of the morphological rules tested based on the total percentage of correct responses. The table provided a composite of the statistical results of this study. The pluralization rules which received the

highest number of correct responses were found to be the first rules learned be children (Menyuk, 1971). The past tense verbs /-d/ and /-əd/ and the possessives were shown to be some of the last rules learned by children (Menyuk, 1971 and Berko, 1958).

Table 11. Rank ordering or morphological rules based on the total percentage of correct responses.

Morphological Rule Tested		Allomorph	Percent Correct
Plural Noun	+	/-s/	84%
Plural Noun	+	/-z/	69%
Plural Noun	+	/-əz/	65%
Progressive Verb	+	/-ɪŋ/	63%
Past Participle Verb	+	/-ɪŋ/	60%
Past Tense Verb	+	/-t/	60%
Comparative Adjective	+	/-er/	52%
Present Tense Verb	+	/-z/	50%
Derived Noun	+	/-er/	43%
Possessive Noun	+	/-'z/	40%
Present Tense Verb	+	/-s/	37%
Present Tense Verb	+	/-əz/	35%
Superlative Adjective	+	/-est/	27%
Possessive Noun	+	/-'s/	25%
Past Tense Verb	+	/-d/	25%
Possessive Noun	+	/-'əz/	10%
Past Tense Verb	+	/-əd/	10%

These were the rules which received the largest number of incorrect responses. Berko (1958) found that the comparative and superlative forms were often not acquired until after first or second grade, with the superlative being the last of the two rules to be acquired. The percentage of correct responses for

the comparative (52%) and superlative (27%) rules obtained by the subjects who participated in this study seemed to reflect Berko's (1958) findings on children. The morphological rules which are clustered in the middle of the range are still in need of more indepth study before conclusions and comparisons can be made. This rank ordering can be of assistance when determining the order of rule presentation to an aphasic who has lost functional use of some morphological rules.

Discussion

There are a number of propositions eminating from Zipf's Law that are relevant to the data produced by this study. Said another way, Zipf's Law can be applied to the study through the following propositions.

1. Length of the word as related to the frequency of occurrence
2. Morphological dependency and necessity
3. Meaning and semantic cues
4. Phonological complexity
5. Monitoring

Zipf's Law

Zipf's Law states that "...The length or a word...is closely related to the frequency of its usage--the greater the frequency, the shorter the word. It can further be shown from speech-sounds, or from roots and affixes, or from words and phrases, that the more complex any speech element is phonetically, the less frequently

it occurs".(Zipf, 1965, p. xi). Zipf sees a sentence as a series of morphological events, with two distinct groups of morphemes creating orderly, meaningful sequences (Morphological dependency and semantic cues find their basis in these morphological events). One group, conceptual words contain independent meaning (house, dog, swim, etc.). Usage of these words permits freedom of arrangement and flexibility (Zipf, 1965, p. 228-229).

The second group of words have meaning within the frame of reference of our perception (he, it, of, for, etc.). These "articulatory words" have a strictly circumscribed usage. It is from their position within the sentence that the auxiliary words derive their meaning (Zipf, 1965, p. 229-230). With reference to the application of morphological rules, Zipf says, these inflectional morphemes differ from other members of the articulatory group in their degree of agglutenation; that is, the degree of crystallization in arrangement. They are even less flexible than other group members (Zipf, 1965, p. 251). This accounts for the orderly process in which words are inflected. When inflection spares a root in a language, it spares it consistently.

Dubois, et al. (1967) and Mounin (1967) found that those grammatical words carrying meaning, (nouns, verbs, etc.) were more frequently retained. Those words carrying no meaning of their own were often absent from the aphasic's speech. Also, the lexical words most often found in the aphasic's vocabulary were words which occurred frequently in premorbid speech. The telegraphic nature of the aphasic's speech was depicted by simple nouns and verbs--

those words that carried the meaning of the intended message.

Morphological inflections were often absent from the aphasic's generated language. These inflectional suffixes appeared to occur less frequently in English than other grammatical forms (Zipf, 1965). In order to apply morphological rules correctly the aphasic must have had at his disposal a thorough working knowledge of the particular rule required. It would seem that since the morphological forms are more dependent on their position within a phrase than are articulatory words the morphological prefixes and suffixes would be absent from the aphasic speech.

Length of Word

The proposition of simplicity of the morphological form and thereby, its relatively high frequency of occurrence seemed applicable to instances where discrepancies within categories were noted. A prime example was the aphasic's knowledge of noun pluralizations forms: /-s/, /-z/, /-əz/. Although there were no significant differences in any category, with the exception of expressive nonsense, discrepancies were noted (Figure 1). The /-s/ which was the most frequently occurring, and simplest form of the three, received the highest scores for correct responses. The /-z/ was used inconsistently, relative to how its scores ranked in comparison with /-s/ and /-əz/. This was not in keeping with Zipf's statement concerning orderly application of morphological rules. The expressive nonsense category lent the most support to the theory. Scores in this category ranked themselves from simple

to complex, frequent to infrequent: /-s/ (76%), /-z/ (48%), and /-əz/ (26%).

The possessives reflected a more complex and less frequently used set of rules. The scores for the three forms followed the complexity, and frequency of occurrence pattern as described by Zipf. Scores for the possessive forms were much lower than for the same noun pluralization forms. In this instance, complexity of form did not seem as much a factor as did knowledge of when and how to apply the rule. Subjects frequently applied the possessive rule to the object being possessed (Correct: "The Bik's nab; incorrect: "The Bik nab's"). Many subjects failed to apply the rule at all.

The scores for the present tense forms: /-s/, /-z/ and /-əz/ were not in line with those of the plurals and possessives. They lacked the orderliness suggested by the frequency and complexity proposition (Figure 3).

The past tense verb forms: /-t/, /-d/ and /-əd/ rank ordered themselves, for all categories tested, in the manner suggested by Zipf's Law (Figure 4).

The progressive /-ɪŋ/ and derived /-er/ (Figure 6) as well as the comparative /-er/ and superlative /-est/ (Figure 5) also rank ordered themselves from simple to complex, frequent to infrequent, in accordance with the proposition.

The first of several propositions or levels of Zipf's Law seems to account for some of the linguistic phenomena in application of morphological rules by aphasics as shown by the data.

Morphological Dependency and Necessity

Dubois, Marcie and Hecean (1967) proposed that the usage of a morphological rule was dependent upon the dictates of the syntactic phase. Their findings are essentially an elaboration and extension of Zipf's second proposition. If the morpheme was one that occurred frequently in the premorbid language of the aphasic and if the phrase required the suffix for comprehension of its meaning, then the chance of the aphasic being able to apply the rule was increased. Dubois, et al. (1967) stated that the reduction of the phrase pattern resulted in diminuation of numerous syntactical rules. Grammatically meaningful words appeared more frequently than other forms. An example of a phrase spoken prior to the onset of aphasia and the same phrase spoken after the aphasia follows: premorbid-- "a drink of good wine;" postmorbid-- "drink wine". As one can observe, all unnecessary forms have been omitted. The basic meaning is still comprehensible. Other sequential elements in the phrase dictate the necessity of the application of a morpheme or morphological rule.

The comparative-superlative forms were the best example of this proposition (Figure 5). Subjects were consistently better able to apply the /-er/ or comparative rule to words. The /-er/ form occurs more frequently than /-est/. In many instances, the /-er/ form was substituted for the /-est/ form in a quite logical manner (big, bigger, bigger or more bigger).

The idea of morphological necessity was one possible reason for the low percentage of correct responses generated at the

expressive and nonsense levels. The open-ended statement presented certain cues for lexical as well as nonsense words. However, the open-ended statements for nonsense words carried all cues for rule usage as the nonsense stem had no meaning and therefore presented no rule cues. Capacity to grasp necessary cues from the open-ended statement alone appeared to be limited.

Morphological and Semantic Cues

The cues which bear relevance to this study are both syntactic and semantic. It was possible for the aphasic to utilize all cues and meanings to generate the correct response for lexical items. This was evident by the high consistency of correct scores for lexical items. Although the same semantic and syntactic cues were present in the open-ended statement for the nonsense statement, the nonmeaningful nonsense words brought these cues to an abrupt halt. Scores for nonsense words were consistently lower than scores for lexical words.

It would seem that if meaning were not a factor, the subjects would have performed the same on both lexical and nonsense tasks. This was not the case, as was shown by the results for question number two. There was a statistically significant difference at the .05 level of confidence between scores for lexical items and nonsense items.

Phonological Complexity

The phonological complexity proposition, although related to the first proposition, needs individual attention when being

applied to this data. Phonological complexity implies that the more distinctive features necessary to produce a sound the more difficult it is to articulate. The aphasic was expected to have more difficulty with the more complex sounds, composed of several features, as compared to those sounds composed of only a minimum of features.

When the noun pluralization forms /-s/, /-z/, /-əz/ were examined, it was determined via the Distinctive Feature theory (Chomsky and Halle, 1968) that there was one feature that differed between the least complex form /-s/ and the /-z/. That feature was voicing. Between the /-s/ and /-əz/ distinctive feature differences were in voicing and the addition of the vowel /-ə/. The addition of the vowel /-ə/ was the feature difference between /-z/ and /-əz/ (Chomsky and Halle, 1968, pp. 176-177). The phonological complexity of the forms could have had an effect on the scores obtained, especially if the aphasic had articulation (apraxia) and/or programming difficulties. This hypothesis would appear sound in that the percentages of correct responses were ranked in the order of their complexity for noun plurals (Figure 1).

Now, however, look at the results for the possessives (Figure 2). These forms were the same as those used in pluralizations; therefore, one would expect that they would be rank ordered in the same manner with the same number of correct responses. This was not the case. Possessive scores were considerably lower and ordered differently than plurals (See Table 7). It was apparent that something other than phonological complexity had a bearing on the scores.

For these three forms it appeared the knowledge of the morphological rule not phonological complexity altered the scores. As for the other rules and forms, there still remains the possibility that phonological complexity may be an artifact in the scores. Only further investigation will aid in the application of this proposition to morphological data.

Monitoring

As a further explanation of the results, Zipf's proposition dealing with internal and external monitoring is offered. Receptive scores were observed to be consistently higher than expressive scores. Dubois, et al. (1967) and Mounin (1967) demonstrated that agrammatic aphasics have difficulty with nonintegrated morphemes such as occurred in the expressive portion of the test. The aphasic was required to select the most appropriate rule and apply it to a given morpheme. The subject was required to integrate this rule to the stimulus word at the end of the given statement.

Significant difficulty was encountered for the expressive portion. The aphasic was obligated to self-monitor if he was to succeed in integrating the morpheme and rule. Many agrammatics with integration difficulties possessed difficulty in self-monitoring but not in external monitoring.

External monitoring permitted the aphasic to comprehend what was being said to him. The intact external monitoring system in addition to the examiner's integration of the morpheme and morphological rule seemed to aid in the increased number of correct responses for the receptive phase.

If the expressive and receptive portions of the test had required similar mental operations to successfully complete the task, then one would have expected both scores to be in close proximity. There was, however, as noted in question one, a statistically significant difference between the two scores at the .05 level of confidence. The expressive task required the aphasic to self-monitor and integrate the correct morpheme. This problem solving process proved to be much more difficult for the subjects than did the receptive task which required the aphasic to monitor the verbal directives of the examiner and then determine which picture stimuli was representative of the rule. The inability to monitor effectively seemed to be one plausible explanations for the difference.

In applying Zipf's Law to this data it is difficult to look at the linguistic phenomena in terms of portions of the law. Individual sections however have stronger relevance to certain portions of the data than do others. It must be kept in mind that no single proposition was applicable to all the data. It is, therefore, necessary to think of Zipf's proposition as a unit when attempting to explaning the data.

Jacobson Hypothesis

Before drawing conclusions about the data, one should look at a continually mentioned hypothesis in studies of aphasic language. Jacobson's Regression hypothesis (1955) described the aphasic's loss of grammatical rules as a mirror of the child's acquisition of rules. Several studies by Berko and Goodglass

(1960) and Goodglass and Hunt (1958) have attempted to support this theory. The data from this study only partially supported the hypothesis. The expressive nonsense portion supported Jacobson's theory better than some of the lexical items. The pluralization rules for the nonsense words supported the hypothesis. The /-s/ which was found to be the first rule acquired by a child (Berko, 1958 and Menyuk, 1971, p. 86) received the highest percentage of correct responses. The /-əz/ which was the last of the pluralization rules to be acquired received the lowest percentage of correct responses for the noun pluralization rules. The possessive rules which are rules acquired after the pluralization rules (Menyuk, 1971) were shown to be more difficult to utilize. The present tense verbs supported the hypothesis as did comparative and superlative and progressive and derived.

For this particular severity group, those forms usually acquired last received the lowest percentage of correct scores; while those forms acquired first usually received the highest percentage of correct scores.

Subject Variability

The subjects themselves appeared to have had a certain effect on the scores. The four subjects that generated the least number of correct responses suffered bi-hemisperic damage. Information as to the site of and extent of lesion was not available but should be obtained in future studies to determine the relevance and effect of this information.

Conclusions

The following conclusions can be drawn from this study:

1. There was a statistically significant difference between lexical scores as compared with nonsense scores in the direction of lexical scores.

2. There was a statistically significant difference for expressive scores as compared with receptive scores in favor of the receptive performance.

3. For pluralization, possession and past tense forms, /-s/, /-z/ and /-əz/ the theory proposing phonological complexity as the causal factor did not apply; that is, errors made in the aforementioned items were not due to the presence or absence of certain distinctive features.

4. As demonstrated in previous studies by Goodglass and Berko (1960) and Goodglass and Hunt (1958), the noun pluralization rules received the highest number of correct responses. This seems to indicate pluralization rules are more often retained than other rules.

5. Aphasics, if given a training period and simplified instructions, can apply morphological rules to nonsense stimuli.

6. The results for plurals, possessives, present tense verbs, comparative, superlative, progressive and derived morphological rules utilizing nonsense stimuli and the expressive mode of response supported Jacobson's regression hypothesis.

7. Results for expressive-lexical, receptive-lexical and receptive-nonsense did not support the hypothesis. This may

indicate that the expressive nonsense items required the subject to have a working knowledge of each rule in order to apply it appropriately; whereas, expressive lexical items could have been successfully completed if the subjects were familiar with the stimulus words.

8. Zipf's Law dealing with frequency of usage of a form as related to the form's length as well as various levels within that law, seemed to apply to most of the relevant findings. The law must be applied in its totality as no one single aspect applied to this data.

Implications for Further Research

1. The present morphological test needs revision as was indicated by certain graphic curves.

2. More indepth morphological investigations are needed with different aphasic populations. This should be done using small groups of subjects to continue baseline information. Later studies would then have a basis for comparison.

3. The effect site of lesion in patients suffering from bihemispheric damage needs to be determined for purposes of therapy and future testing.

4. The exact effects a psychological disturbance, psychosis, or schizophrenia has on linguistic skills is in need of extensive investigation as many aphasics also have psychological complication.

5. A retest using subjects which closely adhere to the description of those used in this study is indicated to determine the effect certain controlling variables have on morphological performance.

CHAPTER V

Summary and Conclusions

The problem of grammatical disturbance in aphasia is significant not only for linguistics but for neurophysiology and clinical diagnosis as well. Differential impairment of the grammatical sturctures of spoken language has often been described in cases of aphasia. Many authorities have distinguished between an "agrammatic" form, marked by simplification and loss of grammatical detail, and a "paragrammatic" form marked by confused and incomplete, but not necessarily simplified construction. The similarities and differences have not been adequately accounted for theoretically (Goodglass and Hunt, 1958, p. 449).

Since the work of Goodglass and Hunt (1958), numerous studies have been undertaken examining the effects aphasia has had upon global linguistic abilities. Only a minimum amount of systematic investigation has been done examining the effect that aphasia has on the retention and utilization of specific grammatical rules. This present investigation was carried out as one of many logical research steps toward identifying parameters of morphological inflections for aphasics.

The purpose of this investigation was to describe specific morphological language skills for ten Group III aphasics in light of certain pre- and post-morbid medical, physical, emotional,

social, and therapeutic variables. Three specific questions were posed at the onset of this investigation:

1. Is there a statistically significant difference in the scores for lexical words as compared with nonsense words?

2. Is there a statistically significant difference in the scores for expressive items as compared with receptive items?

3. For each morphological rule tested, how many correct responses were elicited?

A review of the literature examined relevant linguistic studies, agrammatical studies, and morphological studies. The bulk of the morphological studies lacked adequate control of subject variables and criterion variables; thus, indicating a need for more variable control if a study was to be meaningful. Review of previous aphasia linguistic research resulted in the following generalizations:

1. It could not be determined that the expressive and receptive processes operated independently of each other.

2. The neurological trauma producing the aphasia syndrome brings about the following linguistic impairments:
   a. The inability to sequence phonemes into words and words into familiar grammatical arrangements;
   b. The inability to use words to symbolize concepts.

3. The aphasic's linguistic degeneration is similar to some of the linguistic abilities found in children but quite different with respect to other linguistic areas.

4. The frequency of occurrence of the morpheme or morphological rule seems to have an effect on the aphasic's ability to retrieve the morpheme or rule.

5. The complex behavior of language involves activities functioning at various levels of integration.

6. The necessity of each grammatical form is dependent upon the next higher rank: The phoneme is dependent upon the morpheme, the morpheme upon the phrase and the phrase upon the statement.

7. Agrammatism appears to possess the following qualities:
   a. Extreme difficulty or inability for the subject to integrate morphemes within the articulated phrase that he had previously spoken without error;

   b. Deficit in the formulation of syntactic phrases;

   c. Levels of success are joined to levels of syntactical phrases; morphemes, substantives or infinitives, and lexemes are utilized without any indication of masculine/feminine, singular/plural, tense or person;

   d. Receptive knowledge is usually intact;

   e. Prosody is usually intact;

   f. Syntactical pattern is limited to the nominal phrase structure;

   g. Interpropositional relationships are reduced to forms of position and order;

   h. Substitution of the pause in sequences of phoemes plays the role of noise interrupting the sequence;

   i. Linguistic economy appears in reduction of the statement, and reduction of grammatical rules to those words and rules that have occurred most frequently.

8. The results of aphasic morphological rule competence studies indicate a loss of certain inflectional forms.

The procedures employed to answer the questions posed at the onset of this investigation consisted of the following:

1. A morphological test of the following formational rules was designed from existing measures: plurals of nouns, present participles of verbs, past tense of verbs, present tense of verbs, possessives of nouns, comparative and superlative, and progressive and derived.

2. These forms were tested by means of lexical and nonsense

words requiring the subject to respond expressively and receptively. Line drawings depicting each rule were placed in a three-ringed notebook.

3. Ten Group III aphasics served as subjects for this test. For each subject a record sheet containing pertinent medical, emotional, social, physical and therapeutic variables was completed. The Minnesota Test for Differential Diagnosis of Aphasia was administered to each subject.

4. Ten subjects initially demonstrated their expressive knowledge of the rules and secondly their receptive knowledge of rules. Each subject's verbal responses were tape recorded on an Ampex tape recorder.

The results of the study warrent the following conclusions:

1. There was a statistically significant difference between lexical scores as compared with nonsense scores in the direction of lexical scores.

2. There was a statistically significant difference for expressive scores as compared with receptive scores in favor of the receptive performance.

3. For pluralization, possession and past tense forms /-s/, /-z/, /-əz/ the theory proposing phonological complexity as the causal factor did not apply; that is, errors made in the aforementioned items were not due to the presence or absence of certain distinctive features.

4. As demonstrated in previous studies by Goodglass and Berko (1960) and Goodglass and Hunt (1958), the noun pluralization rules received the highest number of correct responses. This seems to indicate pluralization rules are more often retained than other rules.

5. Aphasics, if given a training period and simplified instructions, can apply morphological rules to nonsense stimuli.

6. The results for plurals, possessives, present tense verbs, comparative, superlative, progressive and derived morphological rules utilizing the nonsense stimuli and the expressive mode of response supported Jacobson's regression hypothesis.

7. Results for expressive-lexical, receptive-lexical and receptive-nonsense did not support the regression hypothesis. This may indicate that the expressive

nonsense items required the subject to have a working knowledge of each rule in order to apply it appropriately. Whereas, expressive lexical items could have been successfully completed, it the subjects were familiar with the stimulus words.

8. Zipf's Law dealing with frequency of usage of a form as related to the forms length as well as various levels within that law, seemed to apply to most of the relevant findings. The law must be applied in its totality as no single aspect applied to this data.

APPENDIXES

APPENDIX I

Minnesota Test for Differential Diagnosis of Aphasia

Screening Items for Group III

A. Auditory Disturbances

Recognizing letters

Identifying items named serially

B. Visual and Reading Disturbances

Matching words to pictures

Matching printed to spoken words

Reading comprehension, sentences

C. Speech and Language Disturbances

Rapid alternating movement

Repeating monosyllable

Counting to twenty

Naming pictures

D. Visuomotor and Writing Disturbances

Writing letters to dictation

Written spelling

Oral spelling

Producing written sentences

Writing sentences to dictation

APPENDIX II

Subject Information Chart

Name:
Age:
Sex:
Address:

Examiner:
Date:
Physician:

I. MEDICAL

A. Premorbid Condition

1. Over Weight
2. Smoker
3. Arteriolsclerosis
4. Diabetes (Controlled--Uncontrolled)
5. Rheumatic Hear Disease
6. Heart Murmer
7. Epilepsy
8. Skull Fracture
9. Tuberculosis
10. Cardiovascular Disease
11. Cancer
12. Pneumonia
13. Alcoholism
14. Other _____

B. Time of Onset

1. Age:
2. Date: _____ _____ _____
   Year Month Day
3. Approximate length of time before medical treatment was administered.
4. Type of Trauma: _____
5. Site of Lesion: _____
6. Extent of Lesion: _____
7. Type of Medication Administered:
8. Complications:

C. Postmorbid Condition

1. Present Type of Medication
2. Additional Seizures: Yes _____ No _____
3. Additional Complications Resulting in Hospitilization:

II. PHYSICAL
- A. Premorbid Conditions
  1. Visual Acuity
  2. Auditory Acuity
  3. Motor Coordination
  4. Preferred Hand
  5. Paralysis
- B. Postmorbid Conditions
  1. Visual Acuity
  2. Auditory Acuity
  3. Motor Coordination
     a. Paralysis
     b. Paresis
     c. Ambulatory
     d. Writing Ability: Preferred or Nonpreferred Hand
  4. Statement of present reading, speaking and language abilities obtained on the basis of the Minnesota Test.

III. EMOTIONAL
- A. Premorbid Condition
  1. Emotional Lability
  2. Disposition with Family, Friends, Associates
- B. Postmorbid Condition
  1. Emotional Lability
  2. Disposition with Family, Friends, Associates, Hospital Staff

IV. SOCIAL
- A. Premorbid Condition
  1. Education
  2. Occupations
  3. Interests
- B. Postmorbid Condition
  1. Occupation
  2. Interests

V. THERAPEUTIC
- A. Premorbid Condition
  1. Speech
  2. Physical
  3. Psychological
- B. Postmorbid Condition
  1. Speech
  2. Physical
  3. Psychological

APPENDIX III

Morphological Rules Tested

EXPRESSIVE PHASE

Nouns	Allomorph	Lexicon	Nonsense
Plural	/-s/	cap	geep
	/-s/	cake	nape
	/-z/	gun	neeb
	/-z/	dog	vabe
	/-s/	coat	veet
	/-z/	door	fid
	/-z/	watch	gutch
	/-əz/	dress	tass
	/-s/	boat	geet
	/-əz/	glass	vass
Irregular /-f/ to /-v/	/-z/	leaf	heaf
Irregular /-f/ to /-v/	/-z/	knife	kife
Verb			
Present Participle	/-ɪŋ/	run	voot
	/-ɪŋ/	ring	chee
Past Tense	/-t/	kick	zap
	/-d/	play	nobe
	/-əd/	bat	bod
Present Tense	/-s/	hit	meep
	/-z/	dig	koob
	/-əz/	race	nazz
Possessive			
Singular	/-'s/	chick	bik
	/-'z/	dog	wug
	/-'əz/	class	nizz
Comparative and Superlative			
	/-er/	big	quirky
	/-est/	big	quirky
	/-er/	few	toky
	/-est/	few	toky

Progressive and Derived	Allomorph	Lexicon	Nonsense
	/-ɪŋ/	paint	zib
	/-er/	paint	zib
	/-ɪŋ/	sail	fib
	/-er/	sail	fib

RECEPTIVE PHASE

Nouns	Allomorph	Lexicon	Nonsense
	/-s/	caps	geeps
	/-s/	cakes	napes
	/-z/	guns	neebs
	/-z/	dogs	vabes
	/-s/	coats	veets
	/-z/	doors	fids
	/-əz/	watches	gutches
	/-əz/	dresses	tasses
	/-s/	boats	geets
	/-əz/	glasses	vasses
Irregular /-f/ to /-v/	/-z/	leaves	heaves
Irregular /-f/ to /-v/	/-z/	knives	kives
Verb			
Present Participle	/-ɪŋ/	running	vooting
Past Tense	/-t/	kicked	zapped
Present Tense	/-s/	hits	koobs
Possessive			
Singular	/-'z/	dog's	wug's
Comparative and Superlative			
	/-er/	bigger	quirkier
	/-est/	biggest	quirkiest
Progressive and Derived			
	/-ɪŋ/	painting	fipping
	/-er/	painter	zibber

APPENDIX IV

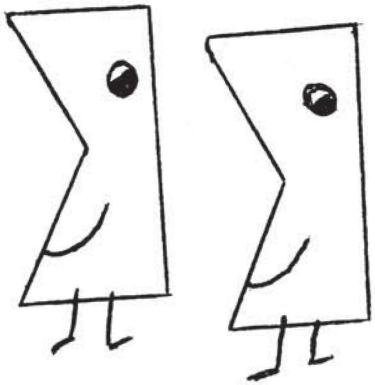
Sample of Expressive Test Plate

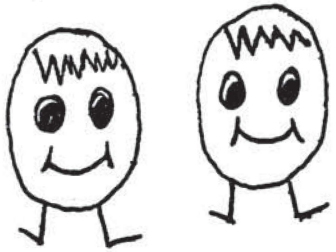
Here is a Geep.

Here is another Geep.
Now there are two _____ .

Sample of Receptive Test Plate

Here is a Geep.





Look at all the pictures.
Point to Geeps.

APPENDIX V

Analysis Sheet:

EXPRESSIVE PHASE

Noun	/-s/		/-z/		/-əz/	
	Lexicon	Nonsense	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____	_____				
2.	_____	_____				
3.			_____	_____		
4.			_____	_____		
5.	_____	_____				
6.			_____	_____		
7.					_____	_____
8.					_____	_____
9.	_____	_____				
10.					_____	_____
11.	.....	.....	_____	_____		
12.	.....	.....	_____	_____		
Subtotal	_____+	_____+	_____+	_____+	_____+	_____

= Lexicon _____ + Nonsense _____ = _____

Verb	Present Participle /-ɪŋ/		Past Tense /-t/,/-d/,/-əd/		Present Tense /-s/,/-z/,/-əz/	
	Lexicon	Nonsense	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____	_____				
2.	_____	_____				
3.			__/-t/	__/-t/		
4.			__/-d/	__/-d/		
5.			__/-əd/	__/-əd/		
6.					__/-s/	__/-s/
7.					__/-z/	__/-z/
8.					__/-əz/	__/-əz/
Subtotal	_____+	_____+	_____+	_____+	_____+	_____

= Lexicon _____ + Nonsense _____ = _____

Possessive

	'/-s/		'/-z/		'/-əz/	
	Lexicon	Nonsense	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____	_____				
2.			_____	_____		
3.					_____	_____

Subtotal

_____+ _____+ _____+ _____+ _____+ _____

= Lexicon _____ + Nonsense _____ + _____

Comparative and Superlative

	/-er/		/-est/	
	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____		_____	
2.		_____		_____
3.	_____		_____	
4.		_____		_____

Subtotal

_____+ _____ + _____+ _____

= Lexicon _____ + Nonsense _____=_____

Progressive and Derived

	/-ɪŋ/		/-er/	
	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____		_____	
2.		_____		_____
3.	_____		_____	
4.		_____		_____

Subtotal

_____+ _____ + _____+ _____

= Lexicon _____ + Nonsense _____ = _____

TOTAL ITEMS CORRECT

TOTAL LEXICON _____
TOTAL NONSENSE _____
TOTAL EXPRESSIVE _____

RECEPTIVE PHASE

Noun	/-s/		/-z/		/-əz/	
	Lexicon	Nonsense	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____	_____				
2.	_____	_____				
3.			_____	_____		
4.			_____	_____		
5.	_____	_____				
6.			_____	_____		
7.					_____	_____
8.					_____	_____
9.	_____	_____				
10.					_____	_____
11.	.....	.....	_____	_____		
12.	.....	.....	_____	_____		

Subtotal

_____+ _____+ _____+ _____+ _____+ _____

= Lexicon _____ + Nonsense _____ = _____

Verb	Present Participle /-ɪŋ/		Past Tense /-t/		Present Tense /-s/	
	Lexicon	Nonsense	Lexicon	Nonsense	Lexicon	Nonsense
1.	_____	_____				
2.			_____	_____		
3.					_____	_____

Subtotal

_____+ _____+ _____+ _____+ _____+ _____

= Lexicon _____ + Nonsense _____ = _____

Possessive	Lexicon	Nonsense
1.	_____	_____

Subtotal

Lexicon _____ + Nonsense _____ = _____

Comparative and Superlative

	/-er/ Lexicon	/-er/ Nonsense	/-est/ Lexicon	/-est/ Nonsense
1.				
2.				
Subtotal				

= Lexicon _____ + Nonsense _____ = _____

Progressive and Derived

	/-ɪŋ/ Lexicon	/-ɪŋ/ Nonsense	/-er/ Lexicon	/-er/ Nonsense
1.				
2.				
Subtotal				

= Lexicon _____ + Nonsense _____ = _____

TOTAL ITEMS CORRECT

TOTAL LEXICON _____
TOTAL NONSENSE _____
TOTAL EXPRESSIVE _____

SUMMARY ANALYSIS

EXPRESSIVE		RECEPTIVE	
Lexicon	Nonsense	Lexicon	Nonsense
TOTAL % CORRECT _____		TOTAL % CORRECT _____	

COMPOSITE SCORE _____

APPENDIX VI

Morphological Rules Ranked in Order of Percentage Correct

Rule	Percentage Correct
Noun Plural + /-s/	84%
Noun Plural + /-z/	69%
Noun Plural + /-əz/	65%
Progressive Verb + /-ɪŋ/	63%
Past Participle Verb + /-ɪŋ/	60%
Past Tense Verb + /-t/	60%
Comparative Adjective + /-er/	52%
Present Tense Verb + /-z/	50%
Derived Noun + /-er/	43%
Possessive Noun + /'-z/	40%
Past Tense Verb + /-d/	38%
Present Tense Verb + /-s/	37%
Present Tense Verb + /-əz/	35%
Superlative Adjective + /-est/	27%
Possessive Noun + /-'s/	25%
Past Tense Verb + /-əd/	25%
Possessive Noun + /-'əz/	10%

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